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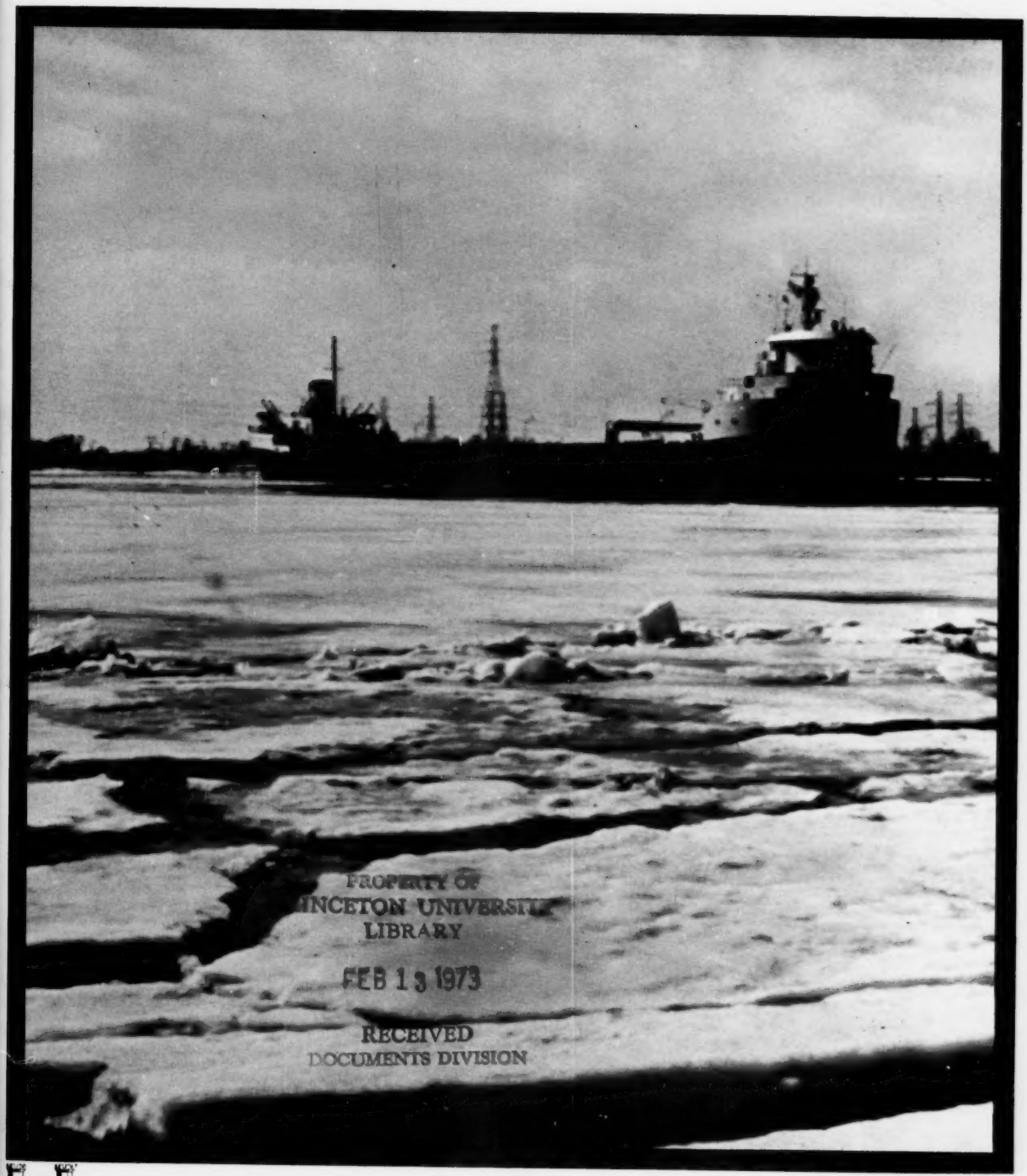

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WINTER 1972-73

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Comments on topics in this publication are invited. Send to:
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COVER: A vessel eases its way through the freshly-broken ice cover of the St. Lawrence Seaway. *See page 15.*

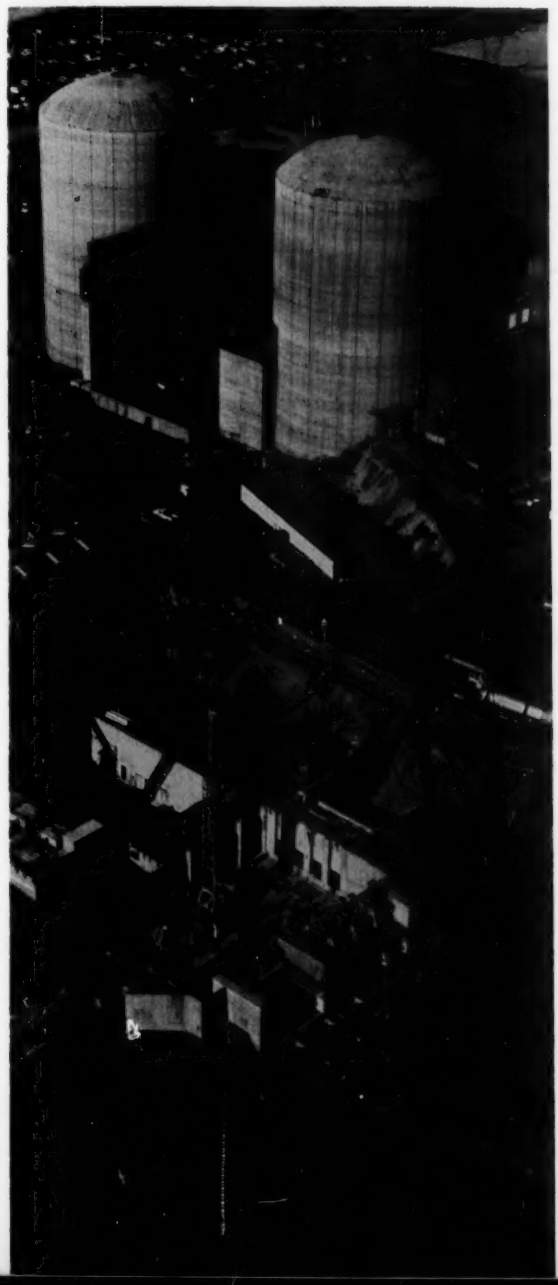
PHOTO CREDITS

Pictures on pages 7 through 13: Snowmobiles on trail and Ski lodge — Soil Conservation Service; Stadium — U. S. Department of Transportation; Hostel — American Youth Hostels, Inc.; Bikes on trail — Bureau of Outdoor Recreation; Snow hikers and Group communication — U. S. Department of Agriculture.

Pictures on pages 15 through 21: Laser beam operator — Maritime Administration; First vessel of spring, ice boom on St. Lawrence River and vessel at Eisenhower Lock — St. Lawrence Seaway Development Corporation.

Picture on pages 32 and 33 — Gerald Brimacombe

CRITICAL PRECEDENT



A major electric utility abandons practice of "decide-announce-defend," and establishes new procedures for resolving energy production—environmental impact confrontations.

by Roland W. Comstock
Director of Environmental Affairs Northern States Power Company Minneapolis Minnesota

As a public utility headquartered in Minneapolis, Minn., and serving a four-state area in the Upper Midwest, the Northern States Power Company (NSP) has encountered intense public confrontation on environmental issues. After seven to eight years of nearly constant conflict, beginning with the battle of the King coal-fired plant on the scenic St. Croix River, the gulf between Northern States Power Company and the vocal public had begun to seem unbridgeable by the start of the 1970s. Translating fears of environmental abuse and nuclear contamination into political and legal action, the company's critics demonstrated their ability to frustrate power-supply planning. At considerable cost in money and good will, NSP had "fought the good fight" in each case (from King to the 345,000-volt transmission lines to the Monticello Nuclear Plant) and eventually won — or did it?

A postmortem of the Monticello conflict — conducted three to four years ago when it became obvious another large new power plant would be needed — revealed that NSP could break the "confrontation pattern" only if it abandoned its previous behavior pattern of "decide — announce — defend." The alternative of open planning, even with serious potential drawbacks, offered at least a good chance for reconciliation.

This article recounts how NSP began its ongoing affair with open planning by laying a major plant siting decision before a panel containing some of its most skeptical detractors. It next focuses on the current plant siting task force, a voluntary open planning effort involving State government.

The Chinese ideogram for "crisis" is a combination of the symbols for "danger" and "opportunity." In the late fall of 1969, NSP was in a position to understand both ideas. An idea was under discussion in our executive offices which meant a restructuring of corporate decision-making on plant siting in a rather fundamental sense: open, public discussion of what had been, in the words of one Twin Cities newspaper, "heretofore a carefully guarded internal matter for the corporation." In effect, it permits the public to have a piece of the decision making process. Many inside the company were hesitant: if the opportunities were clear, so were the dangers. There is a thin line separating "sharing" of responsibility from "surrendering" it. The plant-siting experiment could easily leave NSP with all the disadvantages of prolonged controversy and delay, and none of the advantages of private deliberations. But, putting it all in balance, the company was convinced it was at least worth a try — better than what had happened in the past — and so we started.

WHY OPEN PLANNING?

Out of all we might see coming from the crisis about environment, one clear fact seems to be emerging, that is, the day of unilateral decision making about environmental quality is at least going and perhaps already gone — gone for government, gone for corporations. What is up for grabs in a fundamental sense is the way in which society is going to make decisions on social policy in a time to come. And the rules for acceptable corporate behavior have been turned upside down. No longer can corporations safely rely upon historical value systems or what they did in the past as a way to judge the appropriateness of environmental decisions. The public is insisting to government and to corporations both on the right to judge and to do so on a new set of values.

It is a clear fact that in the future less and less will any institution be able to decide unilaterally what its particular public should have. More and more, the corporate task will be to determine what its particular public wants and then to do it! In the case of public utilities, that is another way of asking: what is the public willing to pay for? Utility obligation then will more and more involve a *complete* disclosure of facts, and less and less will it involve passing judgement on those facts. As applied to plant siting, the speculation was raised that it was not so much the siting decisions that were under attack as the method by which they were reached.

This analysis produced one basic conclusion. Any program to deal with siting problems *must be built on the premise the corporation is willing to significantly alter the traditional decision making process.* Anything less than that is artificial and will not endure. Thus, decision making on environmental problems must, to a larger degree, be *shared.* And that should not be misinterpreted to mean *surrendered.*

OPEN PLANNING — PHASE I

We might describe open planning as far as we've experienced it as occurring in two phases. *Phase I* was characterized by the fact that NSP went to the environmental community and was the convener of the task force.

NSP announced early in 1970 that siting and development of all future plants and transmission lines would be discussed in advance of decision making with the public. To implement this decision we went to every major (and some minor) environmental/conservation group in the State — perhaps some 30 groups. Many of these had been and still are locked with us in bitter controversy. Some were small new groups or ad hoc groups; others were well established large groups. We asked each group to send representatives to a plant siting task force being formed by NSP. We tried to convey the seriousness with which the company was approaching this effort and we asked them to send people capable of making the intellectual commitment and also willing to make the commitment of time. Not one group refused to participate although many were very hesitant, fearing all of this was just a public relations facade and they would be used by the company to their disadvantage. But they took the risk and the task force was formed with approximately 40 members. During this period, much time was spent discussing the whole idea with editorial writers and reporters.

The Governor of Minnesota had earlier formed an environmental cabinet consisting of State department

heads. We invited participation of the Governor's environmental cabinet and they also accepted.

These two groups together with NSP started weekly meetings in March of 1970. Their initial assignment was twofold, the first being to make a recommendation to the company on the location of NSP's next generating station scheduled for service in 1976. Constraints of time required the recommendation be limited to four sites which the company already owned. Their second assignment, after completing the first, was to look at the long-range problems of plant siting (including transmission lines) in a totally unrestricted way and hopefully to develop environmental criteria which the company could apply in the acquisition and utilization of future sites.

The initial meetings were marked by great suspicion and hostility on the part of everyone. Each week we — and in some cases the State — came to take our lumps. It was "gunny sack" time and in the eyes of some NSP people it was a futile exercise in masochism. In the group was almost every major critic of the company.

The initial meetings were devoted to a series of presentations intended to bring everyone up to some minimum level of common understanding about the nature of the electric utility business. Wherever possible we used consultants, people from the university and other non-NSP experts in the hope of enhancing credibility. The outline of subjects to be discussed was prepared by the task force itself.

Along about the sixth week, something very significant happened. The group itself turned upon one of the more outspoken critics and in effect told him to shut up, that they felt they had a chance to do something constructive and that the constant hostility expressed by this one man was getting in the way. From that point on the dynamics of the group began to change.

We also learned very early that if you are to convene a group of this kind, it is impossible to limit the areas of discussion. Soon we were discussing things like advertising and marketing policy and expenditures, research, rates and rate structures, validity of demand projections — things that had never been discussed at a public setting and which, for many within the company, produced much anxiety. All meetings were open to the public and the press was invited — no secret meetings. At least one officer of the company was at every meeting. The initial meetings were kicked off by the chairman of the board who intermittently attended other meetings in an effort to express the seriousness of corporate intent. This kind of demonstration is vital — for such an effort has great credibility problems with the environmental community.

Meanwhile, back at the ranch, the Governor's environmental cabinet began to withdraw from the meetings with the citizens group until we eventually had two separate groups meeting independently of each other. The burdens of staffing these two groups were severe. Any such effort demands complete and total support from all segments of the corporation if it is to succeed. If you can't get that, don't try it! The end result of the first assignment (that is to say the location decision for the next generating unit) resulted in two reports—one from the citizens group and one from the Governor's cabinet. I guess it did not surprise the pessimists that each report recommended a different location. The Governor's cabinet recommended what had been the company's initial choice. We had clearly stated our site preference to the task force at the beginning. After a great deal of internal agonizing, the company elected to follow the recommendations of the citizens group. While the reason for that decision is complex, it basically stemmed from the feeling that the rationale presented by the citizens group was the more sound.

There were many fascinating aspects of this effort which were totally unexpected. For example, there was tremendous involvement and commitment to the whole process by the employees — particularly among the younger engineers. Many began to see the corporate problems beyond the end of the slide rule — and they wanted involvement. Enormous amounts of time were contributed voluntarily without pay by some of these young NSP employees in trying to help the task force suceed. Gradually, this evolved into an informal strategy and planning task force within the company, which was very interdepartmental, very interdisciplinary in character. Even today, when members have departmental problems on which they want help, this group still comes together to draw on each other's knowledge and experience. Perhaps when we look upon this whole effort 10 to 20 years from now, it may very well be this new dynamic introduced into the company in terms of its internal activities was one of the more important things to come out of the open planning effort.

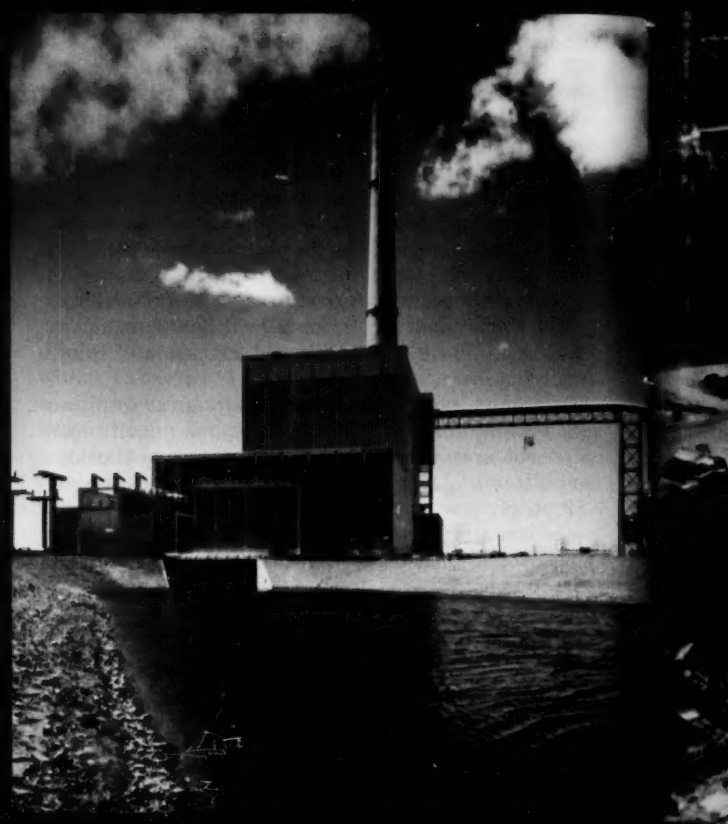
After completing its initial assignment, the task force continued to meet at a rigorous pace, strengthened by the company's decision and their belief that we really listened. It divided itself (by its own choice) into four study groups, each of which made recommendations to the full task force. These four groups are: 1) environmental monitoring programs, 2) identifying future plant sites, 3) development and utilization of those future sites, and 4) the whole question of future energy demands. The press response was uniformly accurate and fair.

WAS IT ALL WORTHWHILE?

With regard to location of the 1976 fossil unit, it has been a long time (about 10 years) since NSP has put a major facility into operation without numerous confrontations and substantial delays — both of which are costly. To date the 1976 unit is pretty much on schedule and confrontation involving it has been minimal. That, I am confident, is directly a result of the open planning effort.

In addition, the company's attention was first drawn to wise use and conservation of energy by its contact with the environmental community during the task force activities. Since then, the company has made an effort to promote wise use and, I believe, will do so with even more vigor in the future.

In the 1960s the company successfully defended its selection of the site for this plant, the King on the scenic St. Croix River. But victory generated considerable ill will.



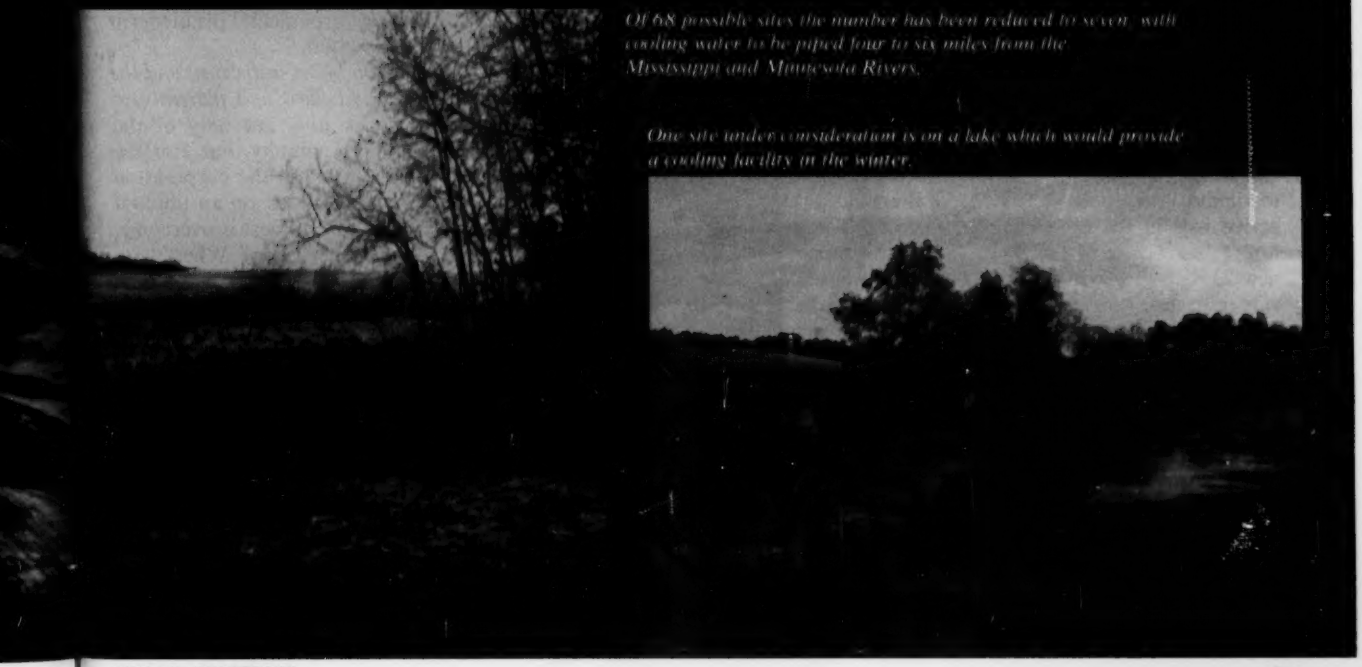
After costly legal actions and confrontations, the company managed to complete its 345,000-volt transmission lines for the Monticello Nuclear Plant.

A postmortem in the late sixties on the company's hard-won battle to construct the Monticello plant led to the conclusion that there must be a better w

After open task force discussions and some major changes in the environmental systems, permits for constructing a twin-unit nuclear station at Prairie Island on the Mississippi River were secured without any confrontation or delay. The second unit is scheduled for completion in 1974.

Of 68 possible sites the number has been reduced to seven, with cooling water to be piped four to six miles from the Mississippi and Minnesota Rivers.

One site under consideration is on a lake which would provide a cooling facility in the winter.



There were other positive results. I think it is significant, for example, that all of the permits from the State necessary for two units at the Prairie Island nuclear station, now under construction, were secured in a very short period of time without any confrontation or delay. Granted, the company made some major changes in its environmental systems at Prairie Island. But the fact remains that at the public hearing conducted by the Department of Natural Resources, none of the environmental groups even appeared to voice a protest. I am willing to speculate this happened in part because the environmental groups were well informed about what was going on at Prairie Island through the task force discussions. They felt they knew all they had to know and, therefore, did not have to show up in the governmental forum to raise hell.

OPEN PLANNING — PHASE II

Members of the Phase I task force also urged NSP to conduct a study that would identify a large number of site options for future plants. Responding to this request, NSP commissioned Commonwealth Associates, Inc., of Jackson, Mich., to search for potential plant sites in or near the company's Minnesota service area. The study began in March 1971 and in its year-and-a-half search turned up 68 possible sites in the southern half of Minnesota. The study contained environmental, engineering and economic data about each site.

Detailed environmental, engineering and economic evaluations were then conducted on 15 of the sites which NSP and Commonwealth Associates considered most promising. From these, NSP identified seven sites it believes are most economical and at the same time low in environmental impact.

Because we believe there is an urgent need for a broader approach to the siting of power plants, NSP has given the study of Commonwealth Associates to the Minnesota Environmental Quality Council, asking the Council to recommend a site for a 1979-80 plant. This Council, recently created by executive order of Governor Wendell Anderson, is composed of the Governor, the State commissioners of highways and natural resources, and the State directors of planning and pollution control.

NSP has told the Council that it will give very serious consideration to a site or sites which the Council might recommend and, in turn, the Council agreed to take an active role in the evaluation and selection of sites for future NSP power plants. The Council then appointed a new 23-member plant siting task force, composed of private citizens from communities throughout the State. This task force was expected to make a recommendation to the Council by mid-December 1972 on a site for NSP's next major Minnesota generating facility. The recommendation is important to NSP in several ways — including the fact that the differential costs among the seven sites is in excess of $20 million.

Phase II then is characterized by the fact that government, specifically the Minnesota Environmental Quality Council, is really running the show. *Instead of NSP convening everybody and sitting at the head of the table, we have asked the State government to assume these responsibilities. Our role is to supply information and to provide counsel.* Further, the range of sites and the period of time over which the current task force is looking is broader.

An important additional factor characterizing Phase II is that other energy suppliers in the State of Minnesota may well decide to get involved in the effort. *If so, we will be seeing government and industry — on a voluntary basis — trying to talk the problem through together on a very broad geographical basis and over longer periods of time.* I am very optimistic about this process. There is reason to believe that it will produce good decisions and produce them in a timely way.

OPEN PLANNING — PHASE III?

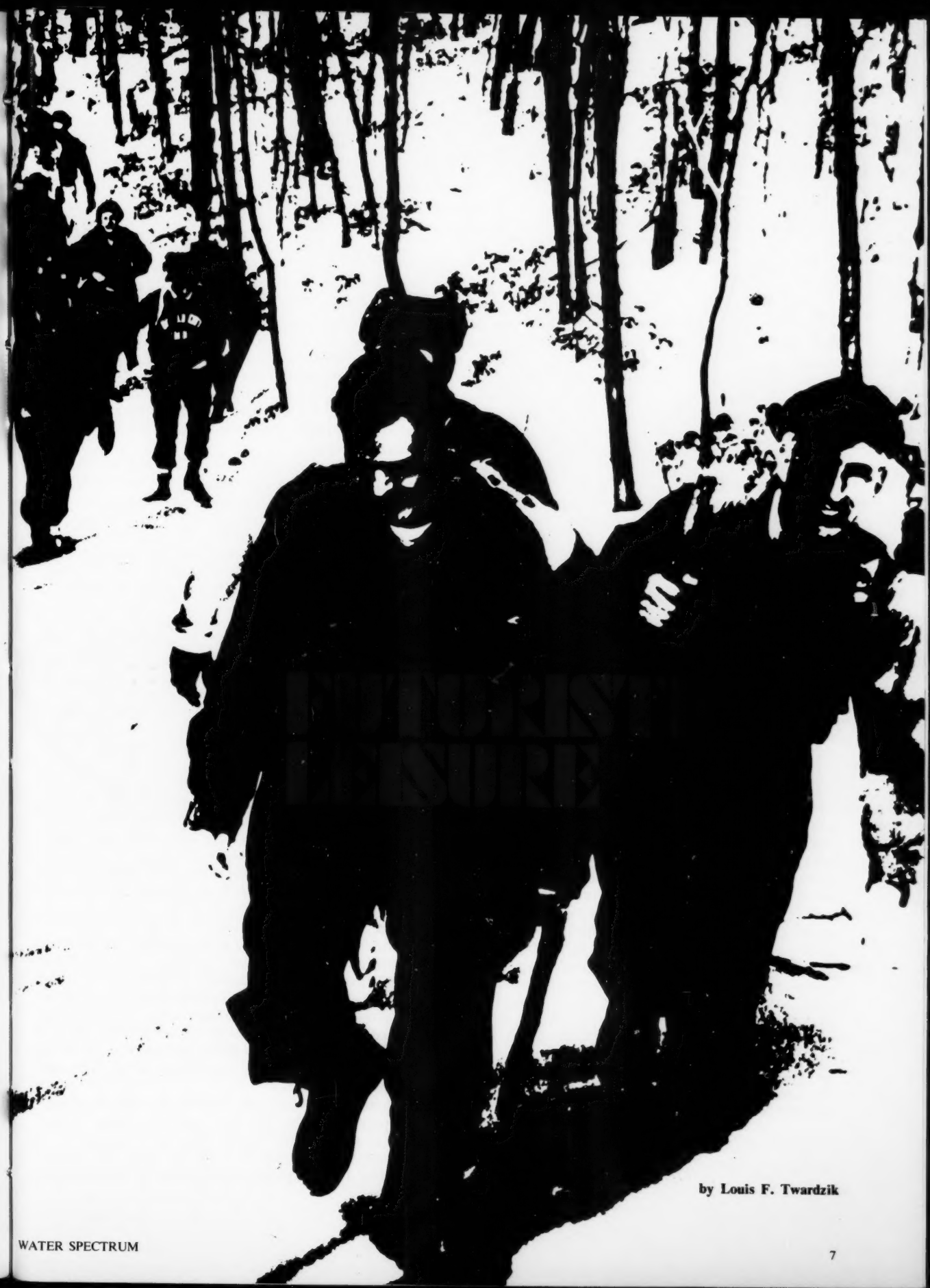
Looking beyond, I see open planning probably moving into something that we might call Phase III. In this period there will be some sort of legislation passed, probably on the Federal rather than State level, which will pull together energy suppliers and multiple State governments on a regional basis — and compel them to engage in open planning over long periods of time. This will probably be a 20-year time frame.

The open planning exercise has been a model experiment. It has been monitored nationally by over 60 institutions. It has been discussed (in positive terms) by such nationwide publications as the *New York Times*, the *Washington Post*, and the *"Battlebook"* series of the Sierra Club. The Canadian government has also studied the process worked out here in Minnesota.

For NSP, open planning has been a good experiment. My only regret is that utilities throughout the country have not seen fit to try it yet. Perhaps they will. The result, I think, of a failure to try it will be Federal legislation that may very well be disproportionate in its impact. There could well be an over reaction on the part of Congress to the whole plant siting question. That tendency might be tempered, however, if individual utilities and States begin solving their environmental problems in mutuality and a more timely fashion.

The major obstacle to such an effort is distrust, and the corporation must work long and hard and patiently to overcome this obstacle. I speak now not only of the distrust by the environmental community, but also the distrust that probably will exist within the corporation itself. The whole process must be based on an implicit faith in the rational man. Once this distrust is overcome, the problems assume an entirely new scope. When there is a feeling that *everybody* is working toward a common objective, suddenly there is the feeling that somehow, some way, *together* we will make it. Gone is the my side, your side, black hat, white hat syndrome.

I think it is fair to say that by every standard — including some that were not anticipated — the initial effort of the task force has been a success both from the corporate point of view and from the community point of view. But it is only a start and, as with any new infant, it will require much tender loving care until maturity.■



by Louis F. Twardzik

With staggered school terms, families will spread their vacation tr
throughout the year; and for the winter season, group participation in vari
types of recreation is already on an upward tr

Ice fishermen of the future will find a greater prevalen
of nearby resorts specializing in supplemental winter recreati

As early as the reign of Emperor Claudius in the first century A.D., Romans enjoyed 159 public holidays during the year. Ninety-three of these were devoted to games at public expense. Festivals were held to honor national heroes as well as military victories. By 354 A.D. the festivities had grown to 200 public holidays per year, including 175 days of games. To assure they would not suffer from overwork, the few remaining days of work usually lasted only until noon.

It is now generally conceded that the Romans' main problem was not having too many slaves, or an over extension in foreign affairs, or that the vestal virgins went wrong — important as all these were to the fall of the Roman Empire — but probably because they did not have a national recreation program. As a result, whoever served as their director of parks and recreation, probably known as the director of festivals and sports, did not have the benefit of a professional education to draw on in developing recreation programs of sufficient scope.

The director's Land and Water Conservation Funds, Open Space grants, State recreation bond funds, and local recreation tax were channeled into developing the monstrous Circus Maximus with a seating capacity of 385,000 and the Colosseum which accommodated 90,000 spectators. There were many other great arenas, forums and circuses and amphitheaters throughout the Empire. "Bread and circuses" became a means to appease the masses. It is generally agreed that the Romans had a highly structured and efficient government because an empire does not operate for centuries without workable systems. The degeneration of these people did not come about because they lacked the knowledge necessary to operate the various systems of government; instead, it is usually traced to their misuse of leisure.

Of course the Greeks had a better idea. They also had slaves and the attendant leisure. But their recreation was conceived in the aesthetics of art and culture and based more on developing a quality of life for all of their citizens. A philosophy of life evolved from their concept of leisure. The word work was not recognized at the time. The closest meaning in Greek was the term unleisure. Places for recreation were not limited nor centralized into community centers or parks. There were instead complexes of libraries, baths, and gymnasiums. There were few spatial limitations on where one engaged in recreation. Instead, the joy of discourse became part of a walk with friends. This life style nurtured the great Greek minds and subsequently the great ideas for a western culture.

Surely, there had to be some recreation park planners in that great society. Plato is probably the best known because of his plans for Utopia, the ideal state. Although his class-differentiated aristocracy, ruled by philosopher-kings, is not currently in vogue, it carried an early civilization a long way. Aristotle of course was the chief exponent of leisure. He held that "man worked in order to have leisure." And that "leisure is preferable to work; it is the aim of all work."

In America, now that we are beginning to accumulate large blocks of discretionary time called leisure, which course do we pursue? Will we continue to follow the Roman concept of designing standards for mass use; X numbers of playgrounds and parks and stadia located for easy and safe access, or will we follow the Greeks' concern for the quality of man's recreation experiences and emphasize the aesthetics of leisure and the place of individual man in the leisure age?

The Roman route is the easy one, of course; it is in easily understood and quantitative terms. If our stadia do not become larger than the Circus Maximus, at least we will have more of them and they will be air-conditioned. On the other hand, it's much more difficult to follow the Greeks by attempting to first find the right questions and then advancing suggestions about improving the quality of life for people as they live it — not merely as it is observed.

Government at all levels along with the vast array of entrepreneurs who make up the private sector are faced with a demand for recreation opportunities as never before — and all because of a new awareness that the distribution of leisure need not follow the traditional pattern of a five-day work week. One of the chief benefits of the book, *Four Days, Forty Hours,* edited by Reva Poor, is that it is timely and ready for public consumption.

No longer shackled with these limited concepts of time and production, the industrial community is now beginning to design work around both the optimization of production and marketing along with the leisure available to management and employees. Leisure pat-

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terns have become increasingly significant in the design of production patterns.

But this is only one part of it and we make grave errors if we feel that the increased leisure of the working force is the only leisure pool we must anticipate and accommodate in a viable society. To ignore the leisure patterns and recreation of other segments of society will set a Roman-type trap of focusing in on a limited segment of the public's recreation needs. The specific needs of youth, the retired, the elderly, the disadvantaged, and even the incarcerated have to be considered along with the work force.

Rationalizing Speculations

Projections of income and population can, along with other socio-economic data, with adequate qualifiers, be plugged into the planning process with a high degree of confidence that they will hold up. However, at this time, it is not possible to make valid long-range predictions of leisure use patterns. This is a period of not just social turmoil but changing social turmoil. There are just too many changing variables entering the leisure picture at

one time to make predictions about it with total confidence. There are changing life styles, changes in the national philosophy about work and leisure, changing amounts of leisure and leisure markets, and of course changing technology. This means that planners are now being forced to make *short range projections* while settling for questionable *long range predictions* about the patterns, styles, and uses of leisure because even the short range changes can be expected to continue in a radical fashion.

Even some model builders agree that although it is possible to develop a mathematical equation that will accommodate all of the variables involved in predicting the impact of leisure over long periods, and their complex relationships to society, the time and energy needed to continually "tend" the model with the facts and constantly changing inputs, makes the value of the entire exercise questionable.

We are therefore at a point in time when we should recognize that the inherent social dynamics of leisure and the concomitant pressure to develop resources for recreation is so pressing and pervasive that long-range projections may be merely academic responses, and costly at that. It may mean that a more thorough short-range analysis of what we have, what we want, the costs, and what do we think will happen is the most useful approach to planning for the development of our free time and recreation resources.

This could mean that our present level of competency in planning, computerization notwithstanding, is limited to short-range assumptions and that their eventual accumulations will more logically develop the long-range projections. If nothing else, short-range planning will permit us the opportunity to continually evaluate the applicability of the questions we must ask about the future.

This then is how the following speculations on developing leisure and recreation are rationalized — they are intended to stimulate thought about the future implications of leisure and recreation resource development which would be required given these eventualities.

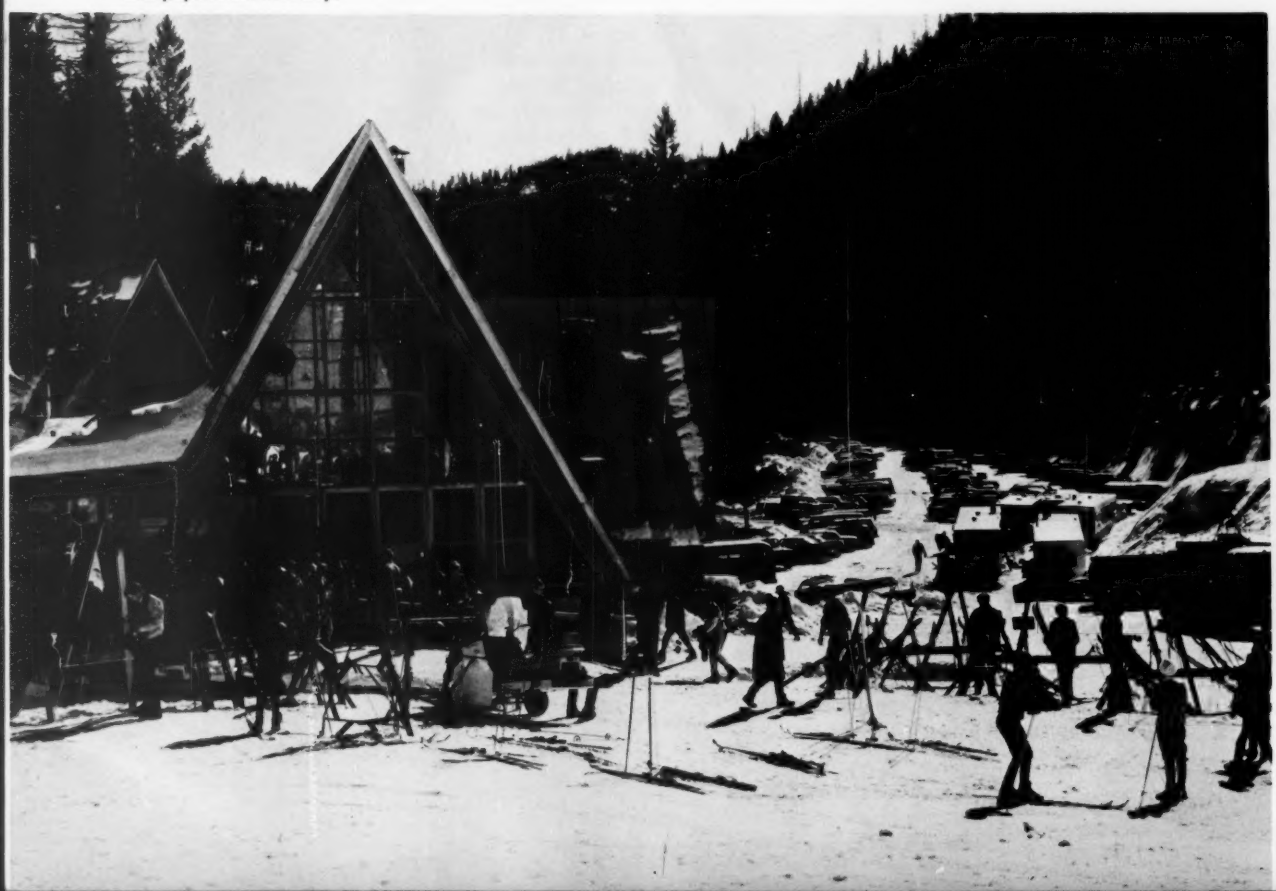
Perhaps the most dramatic changes will be incorporated in the life styles of people throughout the country. These often follow changes that first occur on the eastern and western coasts and ultimately impact all populations in between.

Chief among these will be the continued weakening of the family as the basic and authoritative social unit. We can speculate that this social disruption in tandem with increasing leisure, discretionary income and mobility will provide individuals, formerly tied to a family unit, with more separate recreation opportunities. In other words, the family that plays together may be the exception in the near future.

We can anticipate that:

1. High school and college students will drop out of school for a year at a time to acquaint themselves with

The demand for more winter recreation facilities will reach higher levels—coinciding with more leisure time, money and population mobility.



the environment and the world. They will travel in mixed groups and move about the country and internationally until their wandering and wondering needs are satisfied. Most will return to school.

The demand created by this kind of unstructured, low-cost traveling (formerly known as bumming) by high school and college students may create a market for a system of low-cost hosteling facilities, in the European tradition. These will probably be developed in conjunction with the system of State and Federal trails. The sense of adventure that these young people now receive from traveling by automobile will be transferred to hiking and bicycling.

This particular life-style will probably not be popular with the disadvantaged groups of inner-city areas. They may instead ultimately see special virtue and benefits in finishing high school and college in the traditional manner on the traditional schedule.

2. Second homes for middle and upper socio-economic classes may be located within the city where workers will spend their four work days per week living in apartments. The primary home on the other hand may be located outside the metropolitan area with distance dependent on improvements in mass transportation. The first flood of interest in this arrangement will probably result in the development of say 10-acre sites for the primary home. Within 15 years this should change to the point that the primary home in the rural areas will be an apartment or condominium or some other form of high density living serviced by vast common acreage.

Mass transportation systems will bring more leisure-seeking people to metropolitan areas during all seasons.

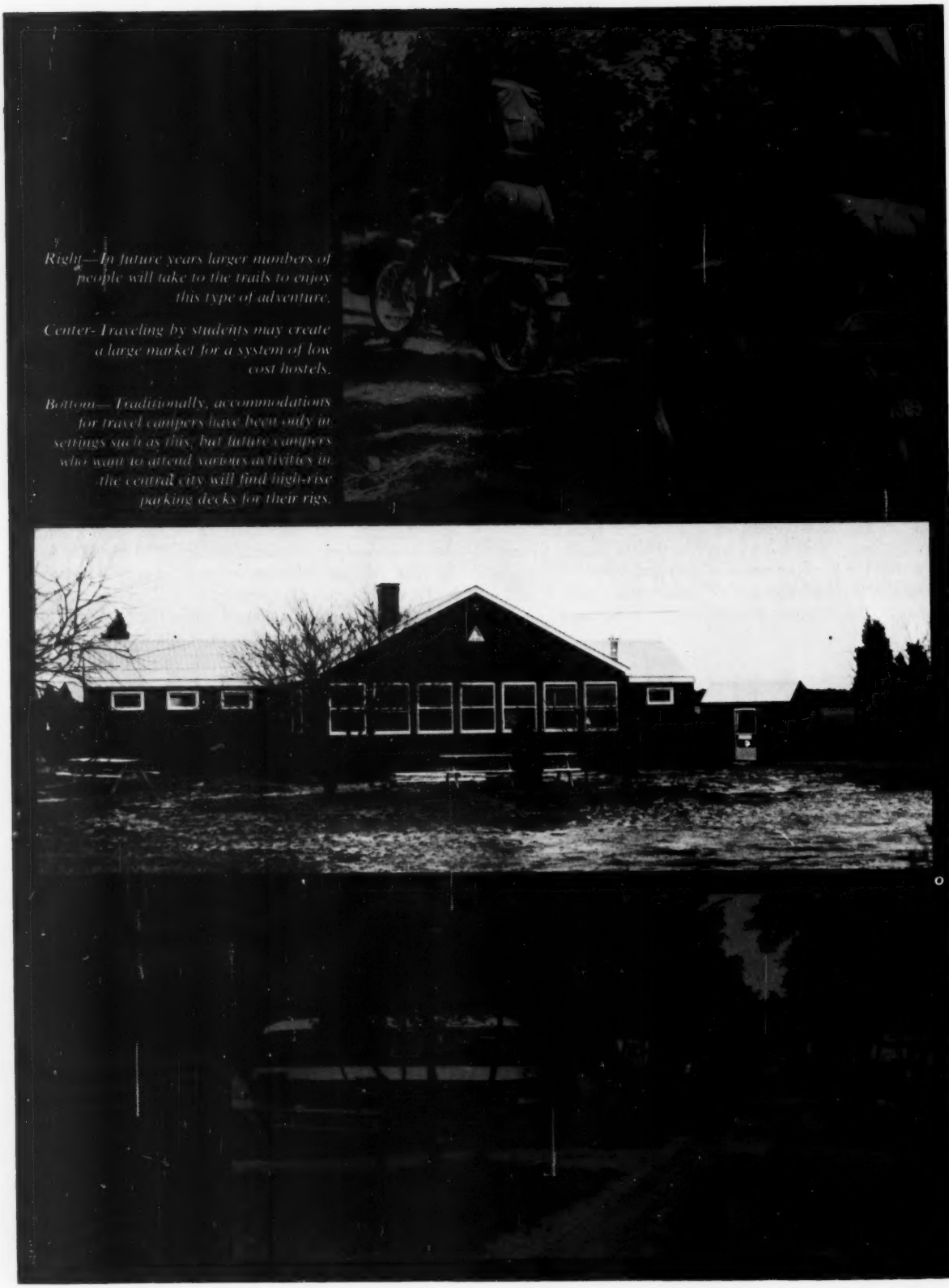
For example, within 15 years all State and Federal forest lands in the northern part of the lower peninsula of Michigan will be ringed with this type of housing while within 20 years all such public and some private forests will be walled in with housing similar to the concrete walls around New York's Central Park. The current problems of obtaining adequate public access to oceans and lakes and rivers may be repeated in the near future, except it will mean purchase or condemnation of apartment houses to gain more equitable public access for the use of the State and Federal forests and parks, instead of seashores. The rate of similar change in high intensity development around many U. S. Army Corps of Engineers and TVA reservoirs will be dependent on quality of water.

3. Many of the small family farms of today will soon be changed into farm estates and ranches. Upper middle class families will take over from present farm families within five to 10 years and develop these marginal acres into hobby farms. Within 10 to 15 years, because of the increase in land values, they in turn, will be forced to sell to upper class families who will develop the farms into estates and ranches.

4. The vegetative life-style, characterized by a constant climate, once found attractive by retirees in the Southeastern and Southwestern States will gradually lose its appeal, or at least be stabilized in the near future. By 1980, and probably earlier, retired people with better health prospects and longer life will either develop a preference for living a retired life in the Northern States with its changing seasons or spend portions of the year in the Northern States and the remainder in the Southern States. These retirees will settle for minimum and high density housing and in the absence of adequate zoning will create land use problems greater than those anticipated for "new towns."

5. An explosion in demand for winter recreation activities is imminent. Not only will there be more families with more leisure and money and mobility, but the pattern of leisure through the changing school year will permit more winter recreation. This change in seasonal demand will be further ballooned from the discovery by the elderly and retired that the new snowmobiles are not limited to youthful users. The smart set will abandon the down-hill skiing resorts and take to the woods, as some already have, via cross country skiing. In order not to follow the fate of the abandoned spas of the early part of the century, ski resorts will soon cater to the middle aged and elderly and provide a silent and easy-to-operate snowmobile. Ski tows will be used during the winter largely for viewing the scenery.

The northern, rural small towns that have retained a sound local government will be rediscovered by the early retirees and families seeking second homes. There is some evidence to suggest that not only are they attracted to the clean rural small town's natural environment with its slower pace and the anticipation of



Right— In future years larger numbers of people will take to the trails to enjoy this type of adventure.

Center- Traveling by students may create a large market for a system of low cost hostels.

Bottom— Traditionally, accommodations for travel campers have been only in settings such as this, but future campers who want to attend various activities in the central city will find high-rise parking decks for their rigs.

Group communication as a form of leisure, in modern day forms, will gain even greater momentum.

the beauty inherent in changing seasons, but also because of the feeling of security such a community imparts to its residents. It also often provides such security through old fashioned policemen constantly looking after "their" people, whom they know individually. On the other hand, a lack of law enforcement for the strung out lake and river front homes and cottages is beginning to take the bloom off the joys of such ownership. Vandalism, especially during the off-season months will reach epidemic proportions among cottage owners shortly. Vandals have become increasingly mobile.

Central Cities

Cost of demolishing large tracts of old housing, business and industrial areas in central cities for purpose of renewing the cities' aesthetics potential will not seem as high in the future. Within 15 years there should be recognition of the need for large scale changes needed to provide open spaces and other aesthetic amenities in order to remake central cities into living parks. The costs will seem a reasonable alternative to the present situation. The plight of inner-cities will of course have to become a little more desperate than it is now before the aesthetic quality of the territorial imperative is recognized as being equal in importance to that of the separate and often dysfunctional components of roads, schools, jails, and welfare programs.

The concept of parks as isolated patches of greenery in communities will disappear from the inner city and other communities. In the future, park planners will take the place of community planners and the object will be to make the place where people live a park and recreation area. All community streets and alleys and streams and schools and shopping centers will be beautiful components of a beautiful community. The need for community parks as isolated patches of space and beauty will therefore no longer exist. Housing will tend to cluster, freeing space to be held as common in order to make these manipulations for aesthetic and recreation uses on a community-wide basis possible.

Central City Tourism

Tourist activity in central cities does not include a significant portion of the army of traveling campers. This is not because campers would not like to visit the cities to attend the various activities unique to them such as baseball and football games, cultural events, or even to shop and look, but rather because it is an environment alien to them.

The economic need to attract these millions of visitors to the central city should encourage the development of special, high-rise parking decks which would accommodate the camping rig. This would permit the camping family to live in their campers in the midst of the downtown area while enjoying the city's offerings. It is assumed that the parking decks will have water, electrical and sewage hookups and that the decks will be open, well lighted and patrolled and available at a fraction of the cost of a family staying at a nearby hotel.

Recreation Farming and Gardening

There should be a continuing awareness and sensitivity to the natural environment by the population in general. This will be manifested in the growing interest by people in the recreation activities of gardening and farming in which the micro-macro natural systems are discovered, understood, and enjoyed. The combination of awareness and recreation experiences could develop a counter

culture for young families in which they may enjoy spending leisure together.

The heavy demand for family gardens, popular during World War II, as victory gardens, will require long-term leasing of land with the entrepreneur providing educational sessions on understanding the relationship of the natural systems existing in the land along with selling plants, seed, mulch, and water.

This extensive and intensive recreational use of land outside of metropolitical areas will become known as a classic foregone opportunity by the agricultural and extension departments. Not being made up of large scale production units, the new gardening movement will probably gain its impetus from ecology oriented associations with much of it based on organic methods of growing. The organic gardening interests will become secondary, however, as families strive, and even begin competing to grow more in limited spaces. The university agricultural community may then enter the picture by sponsoring shows to display the largest tomatoes and the county fair will be rediscovered.

Farms as Social Aesthetic Units

As high quality agricultural lands are identified and zoned for agricultural purposes in some areas, the public will recognize that well managed farms add significantly to the aesthetics of the environment.

With farms providing this extra social benefit while the surrounding rural environment becomes increasingly junky, farmers will receive special subsidy to maintain and preserve and operate their farms as aesthetic units.

Education for Leisure

It is quite possible that the kind of work that an increasing number of people will do will resemble the deadly boredom epitomized by the automobile worker who places wheel lugs eight hours a day. This means that the qualitative values originally associated with work will no longer be available to increasing numbers of people. With more people gaining less satisfaction from work and working fewer hours, the individual and social utility of leisure assumes greater significance.

Initial attempts to educate for leisure will continue to concentrate on skills in sports and social games. This superficial approach to education for leisure will be replaced with a battle between counter cultures in drugs, which stimulate people to various states of euphoria, and an intellectual attempt to resurrect the philosophic life of the ancient Greeks wherein discourse between people becomes the best use of leisure.

Camping

The adventure mystique of family camping is disappearing as it becomes more of a second home on wheels during a vacation. Public agencies will gradually give up the responsibility for providing deluxe second-home camping facilities at a pace to be determined by the aggressiveness of the emerging private camping industry. They will also redesign parks to accommodate camping interests of a contemporary society.

Public agencies will limit camping experiences to the more primitive types. Those who prefer electricity and water and plumbing will automatically seek such accommodations in a private camping development.

Campers who opt for the commercial sites while traveling will be able to make reservations for their entire trip in advance.

Special Populations

The handicapped and disadvantaged including the aged and the poverty stricken will receive increasing attention by recreation planners. Unlike the general population that can usually make decisions about the kinds and amounts of recreation preferences, the special populations generally do not have options. Often they are immobile. Recreation opportunities, if there are to be any, have to be brought to them. Instead of recreation being a positive experience that brings satisfaction, it may in fact be a therapeutic recreation experience that instead brings relief or cure through treatment.

With the growth of special populations, it can be assured that recreation opportunities will be increasingly made available as a form of treatment to the institutionalized aged, mentally disturbed, physically handicapped and the incarcerated.

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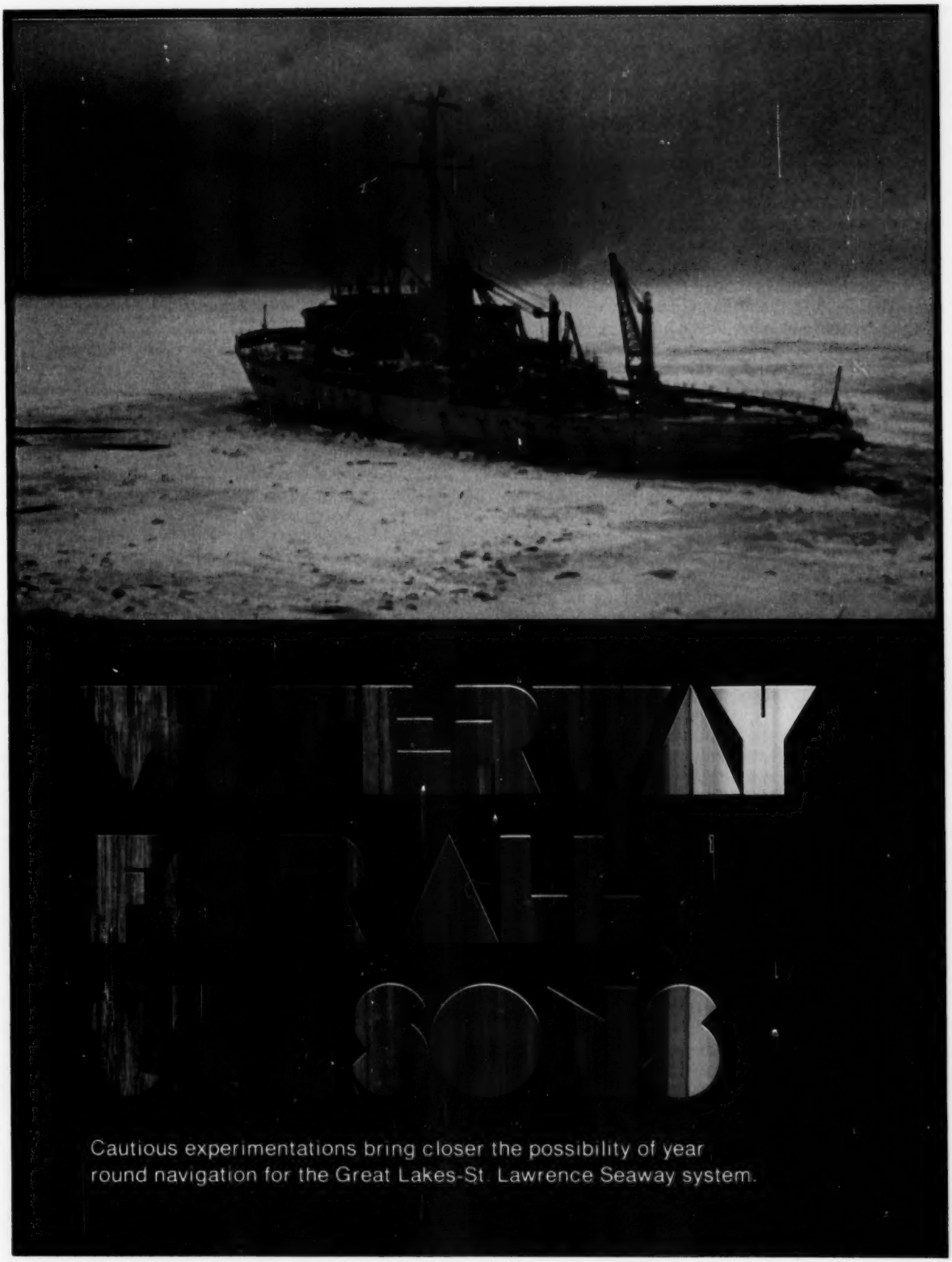
It would seem a useful observation to note that these speculations are based on some real, if only unsystematic observations. If there is any social utility in these it is in the thought that leisure and recreation resource development have grown full blown to the point that they successfully complicate the ultimate social process — the planning of life styles. And with the erosion of the old fundamental truths, the family, patriotism, sanctity of life and conservation — which in the past provided clear direction for social and natural resource development — planners may have to incorporate speculations into the planning processes, at least until replaced by a new set of social ethics. A last thought in defense of speculation as a tool in leisure and resource planning and development is in order: empirical futurists too often serve a limited use when run over by a speculative society. ■



Cautious experimentations bring closer the possibility of year round navigation for the Great Lakes-St. Lawrence Seaway system.

by Michael J. Perrini

Public Affairs Officer
Detroit District
Corps of Engineers

From late March and early April, when the mildness of the winds first shows signs of easing winter's icy grip, until the snow clouds gather again in November and December, the Great Lakes-St. Lawrence Seaway system bustles with nautical traffic of all sizes and shapes — from the giant bargelike "lakers" to the trim "salties," equally at home in the long grey swells of the North Atlantic or the short chop of freshwater seas.

American and Canadian vessels, long familiar with this vast system of interconnecting lakes and rivers stretching from the sea to the heart of North America, mingle with the merchantmen of many foreign registries, including some Eastern bloc countries. During an average spring-through-fall sailing season the "lakers" will carry 90 million tons of iron ore, while the "salties" are moving a combination of five million tons on the import side of the ledger and seven million tons on the export side. Over 11 million tons of American grain, spewed from giant elevators at the twin port cities of Duluth-Superior, move south and east to the world's market places. During the season these twin ports at the western terminus of the system hum with activity, discharging and loading a wide spectrum of general cargos ranging from steel and automotive products to soy sauce and scotch whiskey.

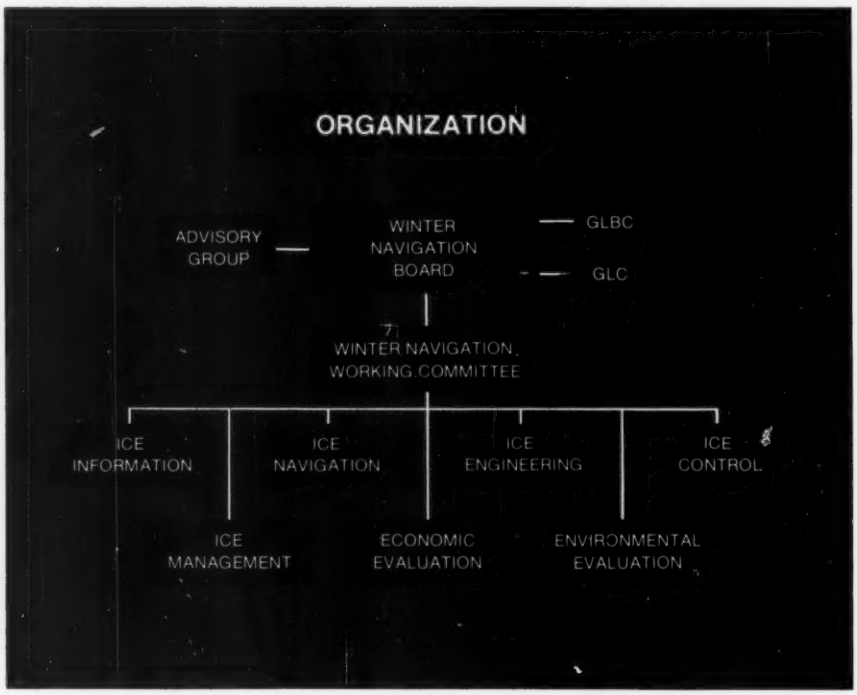
All of this occurs during the normal sailing season. But what happens to this freshwater traffic from late December through mid-March when arctic-like winds blow down from the north, locking these vast waters in icy silence with a thickness of nearly three feet in some areas? Then the ships of summer, fall, and spring either linger in port or work the unfrozen salt water trade routes.

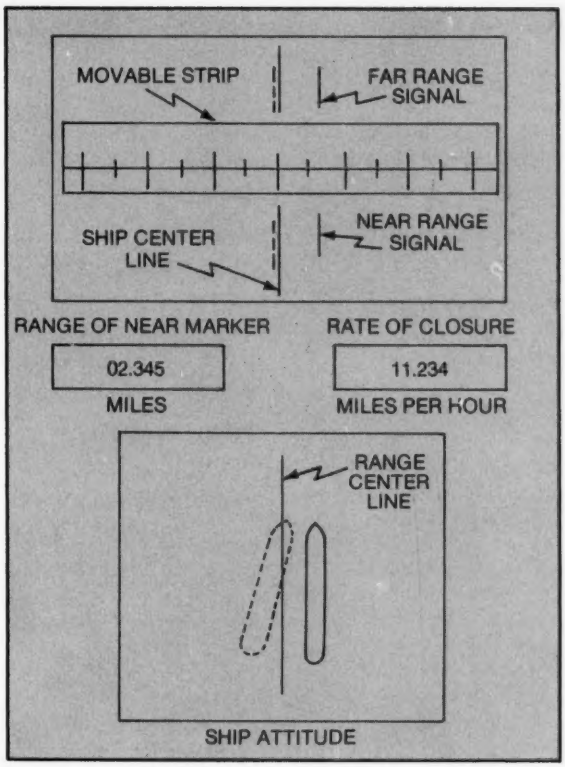
Over the years many people have realized that three-fourths of a year does not constitute maximum use of these vast inland waterways. (There are a few exceptions, such as the railroad car ferries that crisscross Lake Michigan year-round.) But only recently have government, industry and labor acted jointly to attempt an extension of the navigation season.

In 1965 Congress authorized the Corps of Engineers to take a limited look at the feasibility of extending the season. It was soon recognized that such a project would be very complex, and the Corps recommended that further investigation be authorized.

Congress went a step beyond, not only authorizing continuation of the study in the 1970 River and Harbor Act, but also a three-year, $6.5 million program to *demonstrate* the practicability. This current authorization requires a report to Congress by July 1, 1974.

This organization structure depicts the various parts of the demonstration program.





A navigational aid being tested uses the laser beam principle. Shoreline reflectors return the signal, which is translated by computer into a visual wheelhouse display for the ship's master.

The report will come from a consortium of eight Federal agencies involved in the total program, each agency adding its own expertise. These agencies are the Coast Guard, the St. Lawrence Seaway Development Corporation, the Department of the Interior, the Maritime Administration, the Federal Power Commission, the National Oceanic and Atmospheric Administration, the Environmental Protection Agency and the Corps of Engineers. Two other agencies, the National Aeronautics and Space Administration and the Atomic Energy Commission, have been asked to provide technical assistance.

To give direction to the program, a Winter Navigation Board was formed under Maj. Gen. Ernest Graves, the Corps' North Central Division Engineer, with headquarters in Chicago, as chairman. Named vice-chairman was Rear Admiral Albert A. Heckman, commander of the Ninth Coast Guard District headquartered in Cleveland, Ohio. The Board includes members not only of all the participating Federal agencies, but also representatives of the Great Lakes Commission, the Great Lakes Basin Commission, industry, labor, and a Canadian observer.

Board guidance is actually implemented by a working committee comprised of representatives from each participating agency under the chairmanship of Col. Myron D. Snoke, Detroit District Engineer. The working committee is broken down into seven specialist groups called elements.

Funds for the first phase of the three-year program were made available in November of 1971 in the amount of $765,000. Intensive prior planning made it possible to put this money to work immediately. The mild weather prevalent throughout the Northeast and Great Lakes regions last winter also favored an early program start. From Montreal to Lake Ontario, the St. Lawrence Seaway remained open to vessels until December 20, 1971; the Welland Canal, connecting link between Lake Ontario and Lake Erie, was open as late as January 7, 1972. The big story, though, is that Great Lakes navigation history was made when the Sault Ste. Marie or "Soo" Locks and the St. Marys River, both in the connecting link between Lake Superior and the lower lakes and channels, remained open until February 1, 1972, an all-time record for late season operation.

All the agencies involved anticipate more activity during 1973, the second winter of the program, since the President's budget is providing $2.5 million in demonstration and study funds for the intermediate phase of the program.

The demonstration program contains the same seven basic elements represented by the working committee's task groups. Each element has at its helm one of the participating Federal agencies, which serves as the lead agency in that area of study.

Ice Information

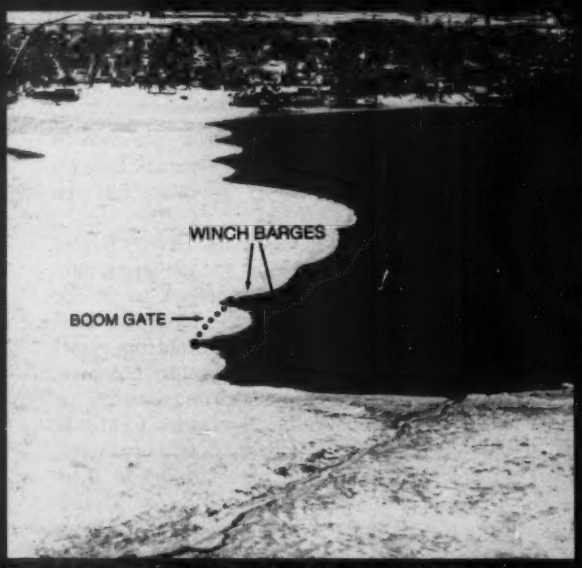
For example, the Lake Survey Center of the National Oceanic and Atmospheric Administration, headquartered in Detroit, is lead agency for the ice information element of the program.

The ice information study is a scientific approach to observing, gathering and disseminating pertinent data on Great Lakes-St. Lawrence Seaway weather and ice conditions.

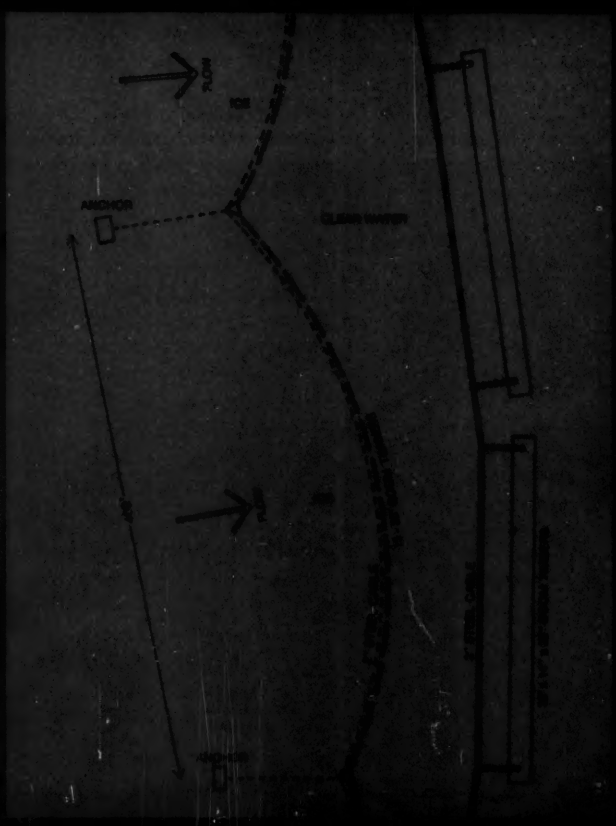
Last winter the St. Marys, St. Clair, and Detroit Rivers were the three areas of concentration for gathering data on the ice information element. A network of 36 ice thickness stations in the Great Lakes-St. Lawrence Seaway complex, reconnaissance flights, reports from vessel skippers, the Canadian Ice Forecasting Center at Ottawa, and surveillance teams made up the prime sources for this type of data collection. An Ice Navigation Center in Cleveland operated by the Coast Guard received, collected, and disseminated ice information and forecasts to both ships and shore based installations. Studies contracted by the National Weather Service, another part of the National Oceanic and Atmospheric Administration, were aimed at improving ice forecasting techniques.

This winter's efforts are being directed toward ex-

This experimental laser beam transmitter was installed on the bridge of the "Philip R. Clarke" long before the start of winter. The operator above is training his beam on a shore reflector which returns a signal to the ship.



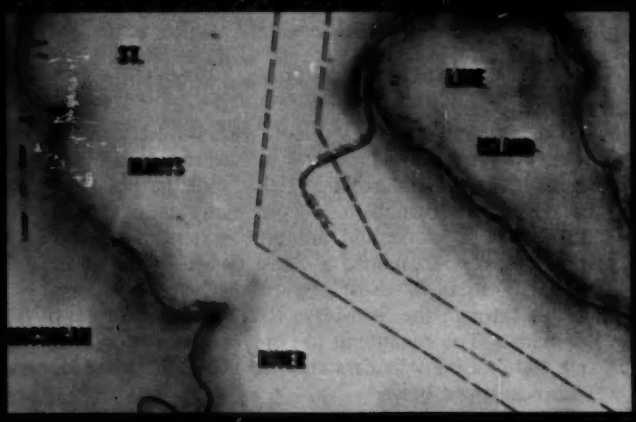
Distinctive scallops are formed on the ice cover by this St. Lawrence River ice boom between Prescott, Ont., and Ogdensburg, N.Y. Local power authorities place the booms across the river each winter to stabilize the ice.



Typical ice boom consists of 30-foot timbers chained to a two-inch cable anchored to the river bottom. One of the scallops has been replaced by an experimental boom gate this winter.

Spring sunlight brightens prospects for rapid break up of remaining ice hampering navigation in the Seaway.

Perforated piping laid along the river bottom directs compressed air bubbles at the under surface of the ice which builds outward from shore at the Lime Island, Mich., bend in the St. Marys River channel.



The Sugar Island ferry has been given a heeled up hull and engine for this winter's battle against the heavy ice formations that prevent winter transportation between Sugar Island and the mainland.

Two bargelike lakers pass within a channel, their dark shells contrasting against the white cover that eventually resists their forward progress with the advent of winter.

panding this work in order to provide more precise forecasts, as well as speedier forecast information to the vessel masters.

Ice Navigation

The ice navigation study element contains three main features — icebreaking, navigation aids, and commercial vessel operation. The Coast Guard, which is the lead agency on this program, engaged in increased icebreaking operations on the Great Lakes last winter utilizing 12 different vessels.

The two monarchs of this 12-vessel fleet were the 10,000-horsepower Mackinaw, a veteran of plowing through the Great Lakes ice fields, and the polar icebreaker Edisto, which has logged many nautical miles through both arctic and antarctic waters. These two large breakers, explained a Coast Guard official, were primarily used to assist the passage of commercial vessels through the St. Marys River and the Straits of Mackinac. The remaining ice breaking fleet contained five 180-foot buoy tenders and five 110-foot harbor tugs with reinforced bows.

Navigation aids used last winter included prototype buoys of a new Coast Guard pop-up design that had already been tested successfully in the more temperate climate of Chesapeake Bay. These buoys are conical in shape with slick skins that help shed ice and keep themselves upright on station in the ice. About six of these buoys, ranging in diameter from five to 16 feet, are being tested again this winter in the St. Marys River and Straits of Mackinac.

There were also seven radar transponder beacons operated by the Coast Guard (under the acronym RACONS) along with nine low-cost, expendable radar reflector plates with lights attached that were emplaced on the shore-fixed ice in the St. Marys River. This combination of devices added to a ship's effectiveness in determining its position after the regular buoys were removed. Improvements on these devices are also being tested this winter.

The Maritime Administration is equally involved in the ice navigation study, currently investigating additional navigational aids using the laser principle. An experimental laser transmitter model was installed last winter on the bridge of U. S. Steel's *Philip R. Clarke* showing distance and closing rate only. This winter a more advanced model will also have attitude and cross-track information displayed as well.

Improvement of vessel construction for cold weather sailing is another aspect of the ice navigation study being researched jointly by the Coast Guard and the Maritime Administration.

Part of the latter's research funding is being used to determine optimum bow configuration for an ore ship operating in ice. In Wärtsilä Shipyards, Finland, the Maritime Administration has been sponsoring tests of alternate designs in an ice model tank for quite some time. Other investigations are underway at Columbia, Md., where a private firm is under contract to find ways of reducing ice resistance, also through the use of an ice model tank.

Last spring the Maritime Administration and the Coast Guard joined Interlake Steamship Company in an instrumentation program designed to check on vessel bending movements and stresses that occur under normal conditions, as well as obtain more information on the effects of navigating through the ice. The company made available one of its conventional ore ships, the *Charles M. Beeghly*, that had been lengthened to 808 feet from an original keel of 678 feet.

Of equal importance is the human factor. How will seamen react to fresh water cold weather sailing? In line with this subject, the demonstration program will conduct tests this winter of protective clothing and other gear that might be used for increasing the safety and survival benefits for ship's crews and longshoremen under cold weather conditions.

Ice Engineering

Lead agency for this program element is the Cold Regions Research and Engineering Laboratory of the Corps of Engineers based at Hanover, N. H. Ice engineering studies are being directed toward improving the design of water-related structures in order to achieve a design best able to resist the ice pressures encountered during midwinter.

One of the foremost problems in winter navigation is to keep an ice-free lane open to vessel passage while maintaining a stable ice cover over *most* of the remaining surface and along the shores of each connecting channel. Every winter the formation of a stable ice cover limits damage and other problems that would be caused by rafts of moving ice in the St. Lawrence and Niagara Rivers and the connecting channels between the Great Lakes. These connecting channels consist of the St. Marys River between Lakes Michigan and Huron, the St. Clair River between Lakes Huron and St. Clair, and the Detroit River between Lakes St. Clair and Erie.

As early as 1942, a Corps of Engineers report recommended use of ice booms by local power companies to form ice restraining structures that would keep the floating ice sheets in place until the spring. In January 1959, the winter before the first installation of booms,

A local steel company uses a self-propelled stacking machine for stockpiling before the winter freeze.

high winds and a rising water level dislodged large fields of ice above Ogdensburg, N. Y. These loosened ice packs jammed under the downriver ice cover at Cardinal, Ontario, drastically restricting Lake Ontario's outflow to the power plant intakes farther below.

Every effort is being made to gain more knowledge in the field of ice behavior by studying the action of such booms in stabilizing ice on the St. Lawrence and Niagara Rivers. These floating 14 by 22-inch wooden timbers, each 30 feet long, are chained to a two-inch steel cable anchored every 400 feet across the river bottom. Each 500-foot section of boom is connected to its neighbors by steel junction plates.

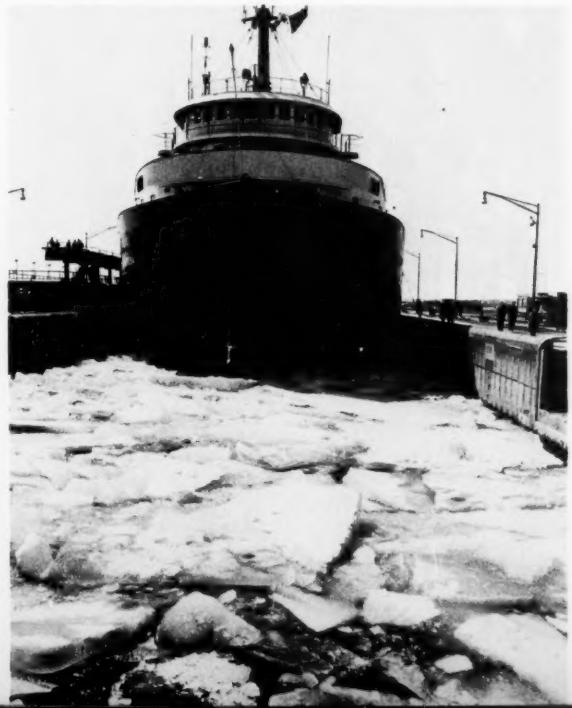
Special instrumentation was developed by the Cold Regions Research Lab last winter and attached to a boom cable to measure ice forces. Investigations were also conducted that year to determine ice pressures on bridge piers with the discovery that these forces exert more pressure than originally thought, according to the Lab investigators.

Ice Control

The St. Lawrence Seaway Development Corporation is the lead agency for ice control studies. The task of this group is to develop methods that prevent or diminish the formation of ice and to set up controls aimed at the elimination of damage or interference factors.

This group is taking advantage of the fact that every winter the Power Authority of New York State and Ontario Hydro install ice booms across the St. Lawrence River to stabilize an ice cover under which the water can flow smoothly into the intakes of local power plants. The booms are installed after passage of the last downstream vessel about mid-December.

Ice is even more of a problem within the restricted area of a locking system as evidenced by the impeded progress of this vessel through the Eisenhower Lock on the St. Lawrence River near Massena, N. Y.



These booms, however, have both a positive and negative effect. The positive side is that they prevent ice jams which would interrupt the free flow of subsurface water and its eventual use in power production. The negative side is that the booms prevent the winter passage of ships.

Therefore, four firms have been contracted by the St. Lawrence Seaway Development Corporation to develop conceptual designs for boom gates that would open and close automatically for each vessel passage. John Officer, a Corporation official, stated that preparations have been completed for an experimental gate at both the Prescott-Ogdensburg and Blue Island areas of the St. Lawrence this winter through cooperation of the St. Lawrence Seaway Development Corporation, which is funding the design, and the local power companies that own the booms. This experimental design will use two winching barges to pivot the boom gate open and close, Officer explained.

Ice Management

This is an element of the program concerned with ice in confined areas as it relates to engineering and control techniques. The lead agency is the Detroit District Office, Corps of Engineers.

Last winter the district installed and operated a compressed air bubbler system at the Lime Island turn downstream of the "Soo" Locks in the St. Marys River navigation channel, the connecting link between Lakes Superior and Huron. Progressive winter build up quickly creates a solid ice cover from the shoreline to the channel at this point, preventing vessel passage.

This bubbler system consists of 3,000 feet of two-inch perforated plastic pipe laid along the bottom and held in place by concrete anchors. A compressor on shore pumps air through a connecting 5,000-foot supply line. The pipe perforations or orifices are spaced 15 feet apart, each one emitting tiny air bubbles that form into a slowly rising column carrying slightly warmer water from the bottom. As described by the Corps representative this bubbler action successfully melts ice at the surface even though its warmer water temperature is only a fraction of a degree above freezing. The constant melting action of the bubbler system keeps the surface ice thin enough to facilitate the turning of ships, which are required to change course here.

A problem of a different nature occurs north of the Lime Island turn in the St. Marys River, where fast moving floating ice hampers winter operation of the Sugar Island ferry that regularly plies between the Michigan mainland and Sugar Island.

Mild weather periods and the passage of vessels result in more than normal amounts of ice breaking loose and drifting downstream from the Sault Ste. Marie area, jamming up along the Sugar Island ferry track and packing inside the mainland ferry slip.

Whenever ice blocks normal ferry service, the Coast Guard cutter *Naugatuck* substitutes as a passenger ferry and clears a lane for the regular ferry.

In an attempt to provide an ice free landing area last

winter, the Corps of Engineers anchored a barge upstream against the shore to fend off ice floating downstream. The Corps also installed a bubbler system here to agitate the slip water continuously while a Navy workboat, locally referred to as a "mule," stood by to flush the loosened ice from the slip.

This year, in a renewed effort to maintain normal passenger and vehicle ferry service regardless of ice conditions, arrangements have been made to increase the power of the ferry engines along with strengthening and streamlining the hull.

Economic Evaluation

The Detroit District of the Corps is also the lead agency for scrutinizing the economic considerations of an extended season. This evaluation procedure is based on the collection of data concerning benefits and costs with the data eventually being applied to an analysis of the program's economic feasibility.

Specific benefit and cost data concerning shipping which took place during the extended navigation period last winter, along with cost information from the demonstration program itself, will enter into the final analysis of economic feasibility and how the ratio of total benefits will look when compared to total costs.

General Graves, as Board chairman, has enumerated five ways in which the extension of the navigation season would yield significant economic benefits:

Attraction of more cargo via the Great Lakes-St. Lawrence Seaway system;

Greater efficiency in the use of vessels on an annual basis;

Reduction of costs involved with maintaining large inventories during winter months;

More efficient operation of terminal and production facilities on a year round basis;

Expansion of the general economy for the vast industrial, recreational, and heavily populated Great Lakes and St. Lawrence regions.

Environmental Evaluation

The last of the program elements is the consideration of environmental factors as they relate to winter navigation. This effort is under the leadership of the Environmental Protection Agency.

The work group coordinating this effort includes representation not only of all the participating Federal agencies, but also from all eight of the Great Lakes States.

The environmental evaluation includes collection of baseline data, assessment of the environmental effects of the demonstration activities, and preparation of an environmental impact statement as required by the National Environmental Policy Act of 1969.

Two agencies of the Department of the Interior, the Bureau of Outdoor Recreation and the Bureau of Sport Fisheries and Wildlife, began their collection of baseline data last winter. So did the Lake Survey Center of the National Oceanic and Atmospheric Administration, observing the effect of the passage of the Canadian icebreaker *Griffon* through the ice in the St. Clair River, the link between Lakes Huron and St. Clair just above Detroit.

Also, all lead agencies in the program are charged with the preparation of annual environmental assessments of their activities as a basis for drafting individual environmental impact statements for each element of the program. Each of these draft impact statements will be updated each year and submitted in final form with the 1974 report to Congress.

Future Actions

Where is the demonstration program leading? Without a doubt, as the program proceeds, we are gaining more and more knowledge about how that fourth season of winter relates to the Great Lakes. This new knowledge will be at the disposal of all those interested in using the information.

As to the prime question of a federally supported extended season on a permanent basis, this will be determined by how the overall costs match up with the overall benefits. Regarding this, two different situations arise: one concerns intralake traffic through the connecting channels and the other overseas traffic through the St. Lawrence Seaway.

With intralake traffic the whole issue depends on how many carriers will want to take advantage of an extended season.

Concerning the Seaway, we know the potential benefits from overseas commerce are great, but the issue depends on how much it will cost to carry out a practical way of keeping the waterway open to foreign traffic.

If a major extension of the navigation season proves to be technically feasible, economically justified and environmentally acceptable, the full implementation of any such plan will require sizeable investments on the part of both public and private interests. Aside from the technical challenge, an extended season will require permanent changes over a broad range of policies and practices involving private interests. Not least among these matters are what vessel owners, insurance companies and labor feel will be to their long-range advantage. Foremost among the questions which ship owners must resolve is whether to modernize their fleets to withstand the rigors of winter navigation. In many cases this would call for new vessels rather than mere modification. Insurance companies must decide whether insurance rates can be decreased to reflect lowered risks which could come from new winter voyage technology. And labor must determine whether ship and dock personnel would be willing to accept the hardships of a winter employment schedule.

These are the type of considerations which can be expected to encompass findings from the current demonstration program. Private interests can use the information in deciding whether possible rewards would be worth the price of participation. If enough private interests think it would, and all tests are met for further public investment, the Great Lakes-St. Lawrence Seaway system will indeed become *a waterway for all seasons.* ■

Legacy of Agnes:

by Mary Ann Striffler

By August of 1972 the news of Tropical Storm Agnes' rampage through the Eastern United States was no longer a national headline topic. But for hundreds of disaster recovery workers throughout the flood area, Agnes was still a subject of everyday concern.

The center of damage recovery activities around the Elmira-Corning, N.Y., area was at Horseheads Junior High. By August the pace of operations there was slowed somewhat and most disaster recovery crews were working only 8 to 10 hours a day and taking some weekends off. . .

Out in the field, construction crews were sandbagging newly rebuilt levees.

Still, the junior high was a scene of urgency. Its gym had no windows and so time seemed to be one eternal night. Those who had desks in the gym were working by the high overhead lights. . .

Out in the field, a contractor could be heard shouting directions to his earth movers.

Movable blackboards and bulletin boards partitioned off various offices. The blackboards and bulletin boards alike were covered with charts and maps and pictures and signs. Everywhere there were indications of "where we are going and where we are now" — work accomplished and what remains to be done. . .

Out in the field, in Virginia, cranes were lifting giant logs from along the debris-strewn James River.

The room set aside for the engineering section appeared to have been a music or band room when school was in session. Damage estimators for the mini-repair program made individual desks by dividing long lunch room tables with pull out stools into separate work areas for several people. Each converted table was equipped with desk lamps and mounds of paperwork. . .

Out in the field, a man was setting up rows of shiny mailboxes in a new trailer court.

The construction section was starting another day. Damage survey teams were reporting in to get their daily assignments and then they were off to various towns and cities in the area. They might have finished surveying their assigned areas by 6 p.m. or they might have had to work on into the night and several more days. The chief of damage operations survey in the Elmira office was handing out assignments, answering questions and studying the completed damage survey reports. People were milling around, asking and answering questions, grabbing coffee and donuts and then taking off. . .

Out in the field, traffic was taking its turn at a new one-lane Bailey bridge crossing.

At Wilkes-Barre in the Daniel J. Flood Elementary School, operations were more hectic. Workers there wore harried expressions and their eyes reflected the long hours they had spent at overtime work. The many phone extensions rang, buzzed and flashed in pinball machine fashion. . .

Out in the field, agency representatives were rushing to their daily coordination session. . .

Tropical Storm Agnes was, in many ways, unique. Rarely, if ever, has any one disaster aroused such conflict, controversy, squabbling, confusion or caused such damage. Agnes put many people out of work. She gave jobs to others. Her residue of physical devastation attracted a few exploiters. She left a wake of destruction and red tape of such magnitude that few areas of human frustration remained untouched.

Even so, orderliness eventually emerged from the chaos. This was brought about principally by a sense of determination in all the affected communities and by local, State and Federal agencies engaged in the recovery work. In Wilkes-Barre and the Wyoming Valley of Pennsylvania the move toward orderliness was reinforced by the assignment of the Deputy Director of the Office of Management and Budget, Frank Carlucci, as the President's personal representative.

The Corps of Engineers was one of the agencies that had responded to the disaster. Its Emergency Operation Centers were already functioning on a 24-hour basis before the storm ended, getting prepared to move personnel and other resources into those areas that would require emergency assistance. Their initial work is completed, but the agency's role in the total rehabilitation of the devastated areas is far from finished. After the spring thaw the Corps will be concentrating on further repairs to levees and other public works while families now in temporary quarters will be moving back into their rebuilt houses, and industries that were knocked out will be going back into operation.

A large scale current exercise is to look at lessons learned and turn them into better patterns of disaster recovery wherever they may occur and, to the extent feasible, into better patterns for disaster preventive measures. A full scale evaluation of all recent disasters is underway and will be provided to Congress in January. The Office of Emergency Preparedness has been joined by the Office of Management and Budget — in cooperation with State and municipal governments and public interest groups — for the preparation of findings and recommendations. For the part of the evaluation that draws on the views of Federal agencies, the experience of Corps personnel during Agnes recovery operations will help indicate which approaches went smoothly as well as define those aspects of emergency recovery and disaster preventive measures which invite change.

As one of many Federal agencies involved in the cleanup, the Corps came under the authority of Public Law 606 which gives the Office of Emergency Preparedness (OEP) overall responsibility for Federal assistance

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Miss Striffler is an Ohio University senior majoring in journalism, and contributed to *Water Spectrum* as a summer intern in 1971 and again in 1972.

Army engineers assisted in the placement and assembly of erector-set style Bailey bridges across disaster area creeks and rivers.

in returning Presidentially-declared disaster areas back, at least to a significant degree, to their pre-disaster state. In this case it meant an attempt to bring the devastated areas back to a pre-Agnes condition.

Projections show the portion of OEP disaster assistance the Corps will have administered by the end of its recovery mission will amount to approximately $126 million. Besides administering OEP disaster funds under Public Law 606, the Corps is carrying out an estimated $14 million in repairs of a permanent nature to damaged flood control structures as part of its own Public Law 99 responsibilities.

Being responsive to OEP's desires meant establishing a completely new temporary Susquehanna Engineer District to cover the most heavily flood-damaged area left by Agnes. Within this new district the Corps set up local field offices to deal directly with the individual residents affected by the flooding.

On-the-spot recovery workers could often shortcut normally involved contract processes in favor of more expedient letter contracts. In the vernacular of the field office workers this "go" type of contract permitted Corps representatives to find contractors, set them to work on such things as cleaning debris off streets and worry about negotiating the price later.

From letter contracts, the Corps gradually switched to using negotiated contracts and a modified form of the usual open bidding process called "competitive bidding." Under the latter, prices still had to be negotiated with individual contractors since it was sometimes difficult to obtain a large number of bidders in a short time. Even though contractors had not been engaged through the competitive bidding process, contractors came in with acceptable bills based on negotiated prices.

The Corps' established first priority after a flood is saving lives and clearing areas that make human travel dangerous. Second comes temporary repairs or, as Frank Coppinger (head of engineering in the Elmira, N.Y., office) called them, "stopgap repairs" to levees, bridges and roads. These repairs are intended to prevent the possibility of a compounded disaster, which could be caused by an "immediate recurrence" of flooding against already disabled protective structures.

Once the immediate emergency was past and these temporary repairs finished, the long haul to total recovery in the disaster area was begun. That's when the Corps' group of recovery workers started clearing streets and working toward restoration of dikes, levees, riverbeds, public buildings and housing to their "before-Agnes" conditions.

Debris removal in the flooded cities, towns and municipalities was one of the first and most massive projects. Although most of the debris removal was from public property, Corps contractors also helped move all foodstuffs from private grocery stores which were declared "public health hazards."

Capt. Donald F. McCullough of the Wilkes-Barre Area Office estimated that contractors were moving 100,000 tons of debris a day for the first two and a half weeks in the Wyoming Valley, and the clearance operations there continued 24 hours a day until late August.

After disaster recovery workers overcame a number of obstacles and collected debris, they disposed of it by the land fill method, utilizing large open expanses, hollows and abandoned coal mine areas. In some cases, the fills converted these waste areas into sites suitable for future development. The obstacles, however, came in a variety of forms.

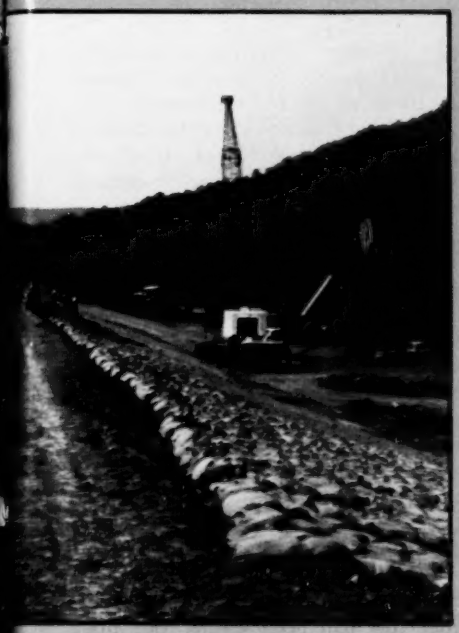
In the Wyoming Valley area around Wilkes-Barre, impounded water hampered debris removal. Water ran off the higher areas as the water subsided, but low spots on the land side of the levee remained under water up to a week after the flood. "We had to get the areas drained as quickly as possible, and we used three methods," Captain McCullough recalled. "We pumped from impounded areas to existing storm drains, pumped from impounded areas to the river and tributaries, and ditched to allow proper runoff. When we exhausted the local supply of pumps, we went as far away as necessary to get the needed equipment."

Traffic problems also encumbered debris removal. To keep people off the streets, most disaster communities set curfews for the first few weeks. In Wilkes-Barre, for example, people were allowed to drive to their homes between 5 and 8 a.m. and then from 5 to 8 p.m. each day for the first week to 10 days after the flood. Afterward, the county passed a resolution asking OEP to have the Corps provide bus service as a way to give the people greater access to their homes. The Corps then met with two local transportation firms, Martz and Wilkes-Barre Transit, and worked with the city in setting up a system

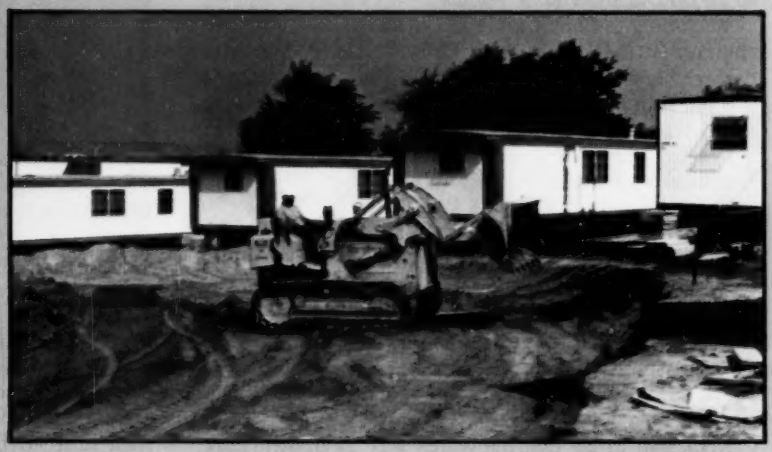
Where pure force of rushing water crashed above and through levees, houses in the flood path were cleared after owners signed releases.

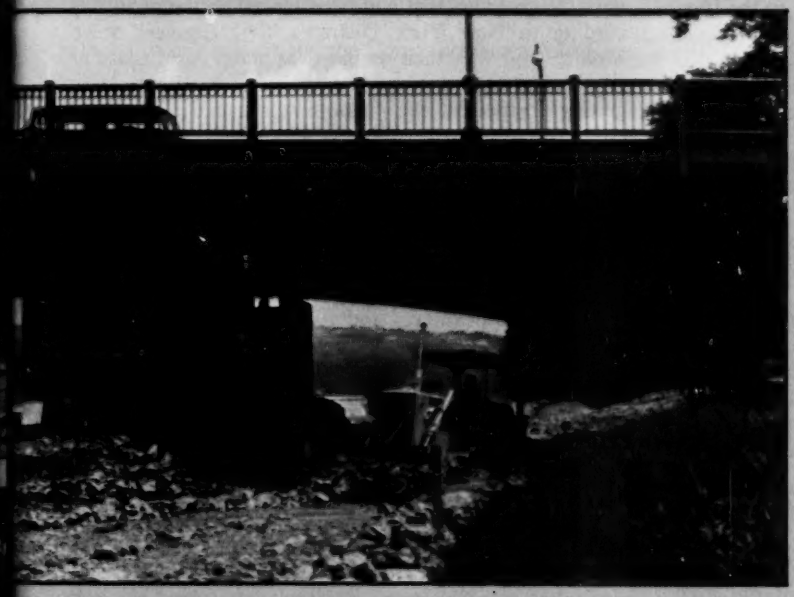
To move some items called for ingenuity.

Debris-jammed creeks caused upstream flooding. Path is now wide enough to handle flood levels normally expected once every five years.



At Corning, N.Y., the levee succumbed to the eddying effect of the Chemung River as it came through a narrow pass under a bridge. Levees there are now back to pre-Agnes height.





Above — Site preparation for mobile homes called for close cooperation between HUD, the offices of municipal, county, State and Federal governments and public and private interests. Corps participation varied at different parks, encompassing such chores as grading, laying utility lines, street paving and replanting the sites.

Left—The Corps put temporary wooden pilings under this bridge to make it safer for traffic.

Trucks dumped over 100,000 tons of debris per day in land-fill sites.

of routing and pickup points outside the area to provide the people with free transportation during the initial curfew period. They extended the service throughout the remainder of the recovery operations period with rider use climbing from 6,000 persons a day before the flood to 26,000 at the end of August.

According to Capt. Calvin F. Curington, assistant area engineer at the Elmira Area Office, "The people with damaged homes were willing to go in, pull out the debris and put it in the street for removal. Their quick response and determination helped make that part of the program a success. They took a willing and constructive attitude and then went ahead and did it."

Agnes dumped debris on the water as well as on land. All these debris clearance missions in rivers and streams were operated in a manner similar to the way Richard K. Rock, Corps construction inspector for the Harrisburg Area Office, supervised the clearance of Clark Creek, a tributary of the Susquehanna River near Harrisburg.

Rock had to see that the debris was taken away, not only from the creekbed, but all the way up to the five-year high water mark along the banks. (This is the level to which flood waters can be expected to rise along this creek on the average of once every five years.)

The urgency in removing the debris dumped by Agnes floods in this narrow creekbed was that any subsequent flood could have washed the same debris back into the creek, causing unintended damming of the water, Rock explained. Also, had the waters risen very high again, some of this debris could have been washed down the creek all the way into the Susquehanna River where it would have been even harder to remove.

To get the necessary debris removal equipment to creek work sites, the contractors usually had to cross private property. That meant Rock or a representative of the State had to ask property owners to sign releases which gave the contractors permission to cross private property lines without incurring liability for accidental damage caused by this equipment.

"We're trying to do a little of what we call 'horse-trading' here," Rock pointed out in the middle of describing what he called a "citizen-Corps relationship." For example, Rock said he often directed the contractor to cut up the debris into fireplace-sized logs and leave them for nearby property owners who needed a supply of firewood for this winter. Other times the contractor would be told to place a little extra fill in especially low spots in nearby yards. This kind of trading usually benefited all parties, saving time and labor the contractor would have had to expend carrying his debris to a land fill site.

It wasn't as easy in other flood ravaged areas. According to Thomas A. Meals, Norfolk Engineer District representative to OEP's Richmond, Va., headquarters, the Corps had to wait for a public hearing before granting permission for contractors to burn the debris collected from the James River running through hard-hit Richmond.

Meals, thinking about that 15-day waiting period, said, "What needs to be considered is legislative authority that permits the Governor or his representative to grant approval to continue whatever work needs to be done during emergency conditions."

In the Harrisburg area, the Corps took on a related yet more urgent debris removal project. There the flood washed its debris into the Susquehanna and distributed along its banks a few hundred drums containing chemicals and oils, some potentially harmful. The Corps contracted to have them picked up and put in a safe place for disposal.

Contractors were asked to dispose of other even larger debris items, too — such as sunken bridge spans. In Corning, for example, the Corps arranged for removal of a 4-span railroad bridge that had been washed out along with the coal cars that had been placed on top of it. According to New York District's civil engineer Steve Monte, who was then assigned as temporary assistant engineer at Corning, the local railroad company, upon getting a report of the possible storm, had run several coal cars out onto the bridge to help hold it down against the raging floodwaters. This damage prevention practice is a common one in this part of the country and really works — sometimes!

Throughout the disaster areas where floodwaters toppled bridges of all sizes, the hastily erected barricades that were used to turn back traffic began to take on a permanent appearance; and road department estimates (up to two years would be required) for their replacement didn't ease the situation. But Bailey bridges did. These preconstructed bridge sections were pulled out of Army storage and within days breached the river-washed gaps, easing pressure for the design and construction of replacement bridges more permanent than their predecessors.

Although the Civil Works Directorate has carried most of the responsibility for the Corps' share of the disaster recovery operation, the Military Engineering Directorate coordinated the Corps' release of the Bailey bridges for emergency transportation requirements and wherever the Army furnished its own personnel and equipment to assist in these bridge installations.

While the bridge crews restored normal traffic patterns, other crews checked out possible damage to dams where erosion might have weakened them to the point of rupture. They also checked and repaired eroded levees and dikes that now posed an imminent threat to the communities they had once protected — before Agnes. All of these levees, dikes and dams were returned to their before-Agnes conditions under Corps direction.

A sense of determination was a key force in the recovery effort.

Much of the flood damage was caused by the pure force of rushing water as it crashed above and eroded through the protective levees. In the Wilkes-Barre area alone, there were five major breaches in the levees on either side of the river and the Corps contracted for their repair the Wednesday after the flood. The same local contractors who had originally worked on the levee system were sought out, so that the levees could be restored to before-Agnes height in quick order.

The related repair of pumping stations along the levees was also essential in preventing another immediate flood. In a high water period the flood gates are closed and runoff on the city side of the levee must be pumped over the levee and into the river to prevent water from backing up behind the levee and causing local floods.

The Corps' Harrisburg area engineer, Jerold Van Fassen, characterized another phase of recovery work as "really outstanding." He was talking about getting the Harrisburg sewage treatment plant back into operation. Van Fassen attributed the success of the repair job to "everybody pitching in." Most helpful was the fact that a local architectural engineering firm already knew how the plant operated and with other local firms under Corps contract completed the repair work in record time. The sewage treatment plant was fully operational in less than five weeks after the flood, yet preliminary estimates indicated that such extensive repairs would take six to nine months.

Although the Corps does not usually get involved in the repair of privately owned property, Agnes was not a usual storm. From the time of the initial emergency, when people were calling all agencies for help and direction, the Corps dealt with private citizens in several ways. One was helping with mobile home site preparation — not necessarily a new type job for the Corps, but certainly never in Agnes-size proportions.

The mini-repair program, however, was a new area of work in the Corps' flood-fighting history, and grew straight out of the mobile home program — partly because the Department of Housing and Urban Development (HUD) was faced with a shortage of trailers and an immediate need for emergency housing.

HUD, the respective States and communities and the Corps worked in close cooperation on both these projects. HUD decided if the flood victim's house was habitable. If not, then the family was eligible for "emergency housing." In Pennsylvania, even campers were made available for "extremely temporary housing." A family could park the camper in its own driveway for cooking and sleeping until its home was fixed.

Wherever possible, HUD hooked up its trailers right in the driveways or yards of these homeless families since it usually made people feel a little less displaced to stay in their own neighborhoods. If this was impossible, then HUD arranged for them to move to one of the new trailer parks.

The State generally leased this land for a year to 18 months at the cost of one dollar. After that time, the land will revert to the owner in its trailer-ready state.

In Wilkes-Barre, the Corps' site preparation duties encompassed grading, laying utility lines and, in some cases, even paving the streets.

"Our whole goal," said Maj. Harold L. Matthias, deputy engineer for the Harrisburg Area Office, "was to build something that is safe and sanitary for up to two years." He stressed the point that the trailer park designers tried to make sure that they "did not build any instant ghettos." Aesthetic considerations extended to angling each trailer so that the view from several of its windows would not be merely the side of another trailer. This gave the visual effect of more space. Curving roads gave "the feeling of suburbia instead of temporary construction."

Any family eligible for emergency housing was also eligible for the mini-repair program. Thus, if repairing doors and windows could restore security to a flooded house and if minimum repairs (amounting to $3,000 or less) could make the house habitable, then the family members could opt to accept those repairs and move back into their own home instead of a camper or trailer. "Minimum repairs" included repairing or replacing furnaces, hot water heaters, electrical outlets, switches and fuse boxes, occasional steam cleaning, repairing steps and eliminating safety hazards — just the essentials, in other words.

In Elmira, both HUD and the Corps made estimates to determine if a particular house could be repaired for $3,000. If so, the homeowner signed a release that allowed the Corps to hire a contractor who, in most cases, had about two weeks to complete the work.

"Sometimes you feel sorry for the people if their home is damaged and there is no way the home can be made liveable for $3,000. It kind of tears you up that you can't do more for them," said Joe Jacobazzi, an estimator

At all rivers and tributaries throughout the disaster area, as here in Little Turtle Creek near Pittsburgh, workers pushed to finish cleanup operations before the winter freeze and the heavy runoff that will come with the spring thaw.

for these home repairs in the Corps' Elmira Area Office.

There are some who feel that the mini-repair program should have started sooner. Those who had done nothing in the way of cleanup benefited more than those who had started repairs themselves. For example, the man who had fixed nothing could get his furnace repaired free while the man who had already hired a repairman to fix his furnace could only hope for a Small Business Administration loan. At Wilkes-Barre, those who were working on temporary housing felt, in retrospect, that HUD and Corps estimators could have visited the houses together and then, as soon as the Special Program for Emergency Economic Development (SPEED) people had cleaned a house, the Corps could have started its temporary repairs. They contended that cleaning out the house and installing the wiring at an early date would have been a morale booster for the people.

In some of the flood disaster areas, the Corps was involved with private homes in still another way. In Wilkes-Barre, the city itself asked the Corps to help in evaluating the structural soundness of both public and private buildings. If the buildings had severe structural damage the city or county obtained the property owner's release and they were demolished.

In Corning, Wilkes-Barre and Kingston, there was a problem in getting homeowners to sign such releases. At Corning, in areas designated for future urban renewal, homeowners did not know whether they should try to rebuild their houses only to have to move in a few years, or whether they should just sell and move immediately.

The "Power to the People" project was yet another aspect of the flood recovery work but one that took an unusual twist. When OEP asked the Corps to provide emergency electric power to the people in the Wilkes-Barre area, Corps project officer Capt. Charles C. McCloskey turned to Navy Chief Norman Brodoski, an equipment operator who was asked to stay for the entire summer after volunteering while he was at home on weekend liberty from the Philadelphia Naval Base. Captain McCloskey assigned Chief Brodoski as operations field chief for the "Power to the People" project in which skilled manpower from the regular Navy, its Seabees and the Naval Reserve worked with material furnished by the Corps.

The original five teams that launched this "Power to the People" program each had six operative electricians, one truck driver and one jeep driver. The two local power companies, United Gas Improvement (UGI) and Pennsylvania Power and Light, helped where possible, especially in providing the teams with meter lists. The local electrician's union also offered some assistance.

Chief Brodoski described the operation simply in the following terms. "We were taking a team of men, going into a house and checking their circuits out. If they were not shorted out, we would give them full power."

If power could not be established through the existing circuits, the teams ran a 50-foot service wire through the panel box and put a 4-inch square box containing two duplex receptacles on the end of the wire. Once the homes had power, their former occupants could come back and begin working on the cleanup. These teams also replaced fuses and circuit breakers when necessary, at no cost to the residents.

The "Power to the People" teams covered an average of 150 to 200 homes a day with up to 14 teams working at the peak of the operation.

Inevitably, a good deal of emergency and disaster recovery work must be devoted to writing reports and filling out applications of various sorts. Thus, one of the Corps' largest tasks was assisting in the completion and routing of damage survey reports. "This is the crux of contract performance," John Castanza, chief of damage survey operations in the Elmira Area Office, said. "The people here don't get paid unless the damage survey is made," he added.

Castanza explained that once the local applicant — a city, a county or other municipal entity — had reported

its damages and their location, the Corps could send out a team to handle the damage surveys in one area. The team met with the signer of the application — probably the mayor or another municipal official — and together they visited the area.

If the amount of repair work was too great for the local entity to handle, the applicant requested, via a "resolution," that the appropriate Federal agency handle the work and do the contracting. If the local governments contracted the work themselves, they filled out an additional "152" form to get reimbursement from OEP. In the New York State portion of the flood damaged area, the Corps helped OEP by making "engineering analyses" and reviewing the 152's.

But even paperwork is not without its difficulties. "We had a shortage of experienced inspectors," Castanza said. Mistakes on a damage survey report meant time consuming corrections and resubmission — several times on the same report, in some cases.

There were other, more general, problems that Corps workers encountered in the disaster program. According to Col. John F. McElhenny, the district engineer for the newly formed Susquehanna District at Harrisburg, the main problem in establishing the Corps' new temporary district was "trying to become operational and, at the same time, recruit people for the district."

Still the colonel called his new district a "very desirable organization," because it frees the regular districts to do their normal work and "allows people here to spend full time on disaster recovery."

Nevertheless, for emergency operation offices all over the disaster area the constant turnover of personnel caused problems. Often the people temporarily assigned were scheduled to leave before their replacements arrived. Also, in some areas the employment of large numbers of local personnel, who were untrained in the work to be done, resulted in erratic and sometimes inflammatory relations with the public.

Many transportation and communication problems also interferred with the initial recovery work. The flood destroyed many cars and it was difficult to obtain needed transportation for emergency workers. Flood fighters literally had to run back and forth from the office to the field to find out needed bits of information.

For improved communications a project engineer suggested that recovery workers should have had greater use of walkie-talkies, radios and in-car telephones.

One member of the disaster recovery team observed that many workers were familiar with the old disaster law, Public Law 875, while Agnes recovery falls under Public Law 606. The two laws are similar, but nonetheless "just enough different to cause confusion." Also, many people unknowingly would ask an agency for assistance that would have required work outside its legal authority.

Thus, misinformation among local people and even the workers of various agencies as to exactly what each agency could and could not do proved a stumbling block in the initial stages.

Complaints about red tape and other matters that slow down operations is common in any disaster recovery program, but the size of the Agnes recovery campaign was such that confusion was proportionately higher. So much so that the corrective measure taken by the President for Pennsylvania's Wyoming Valley was a new way for handling Federal emergency assistance. His definitive instructions to Mr. Carlucci covered four areas:

1. Work closely with the flood victims themselves. Meet with them. Visit their homes and businesses. Listen. Seek their ideas and criticisms as a guide to actions.

2. Combine all available talent, not only in Pennsylvania but in the entire Federal Government, into one effective, well-coordinated team geared to meet the immediate and long-term needs of the people.

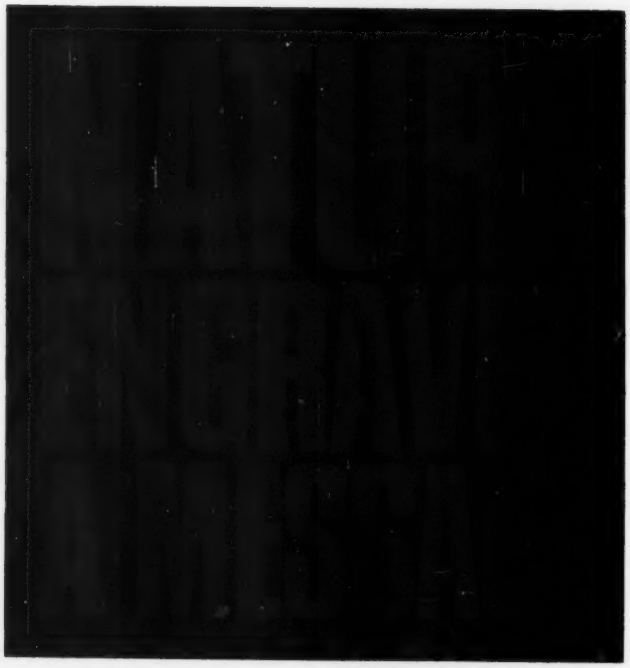
3. Within the law, change or discard any rule if it will help even one family.

4. Steer clear of politics. Concentrate on results.

Four weeks later, among points brought out in a memorandum to the President, Mr. Carlucci said, "Almost every day, as you instructed, I've walked through the streets where the worst damage occurred. I've also visited farms and smaller cities both downriver and upstream. Always, the people were very friendly. They needed resources, and these are now coming in. But in the square, on the streets, in their homes, in their stores and on their farms I have found something more important than resources. That is a firm determination to come back . . . better than ever."

Mr. Carlucci also stated: "I can now report a greater confidence in the Federal Government and in its ability to deliver. Your personal interest has brought about results which the people can measure."

Traditionally, the response to disasters brings out the best in man and his institutions, if not always in proficiency at least in intent. Recovery work for Agnes is no exception. Yet every disaster leads to two areas of impending actions: as recovery teams finish their final chores and depart, most are on their way to their regular jobs where they feel with a degree of certainty that, only in a matter of time, another disaster emergency will arise. Others turn to an analysis of which potential disasters are preventable, and to an evaluation of disaster risks versus prevention costs. They all feel the urgency of improving the level of recovery techniques and of reducing disaster occurrence, because in each area where disasters could strike the communities are growing; and this growth itself calls for a level of emergency preparedness which could cope with the higher damage probability. ■



by Harold E. Miner

In June 1972, *nature* wrote a series of impact statements on several big resource programs. These were, among other things, *environmental* impact statements. But *nature's* impacts are seldom confined to any one sphere of interest; instead, they are all-pervasive. The tangible and intangible costs of preventable disasters, that need not happen, far exceed the price paid for those prevented.

Here is a summary of the 1972 series:

In the year 1972, flood waters came down the Columbia Valley in volume exceeded only once in recorded history. The damage done was insignificant. Few people in the country at large even knew about it. For the Columbia River Basin has a well developed, though not yet complete, Federal-State flood control system.

In the year 1972, flood waters descended on the Missouri River Basin in volume that a few years ago would have caused a great disaster. Here too, damage overall was relatively small; only one locality was hard hit. The Missouri Basin also has made good progress with its flood control system.

In the year 1972, Tropical Storm Agnes brought record or near-record volumes of rainfall to the watershed-divide area where the headwaters of the Potomac, Ohio, and Susquehanna Rivers originate. In the Ohio Valley the damage was minimal, for the portions hit by Agnes have substantial systems of flood-control reservoirs and other works. But in the Potomac and Susquehanna areas, the flooding took 118 lives and in dollar terms was the greatest natural disaster in United States history. Environmental damage too was incalculably vast. Only rudimentary flood control works had been provided in the Susquehanna Valley, and virtually none at all in the Potomac.

The lesson of the Columbia, the Missouri and the Ohio Valleys in 1972 reaffirms similar lessons taught year after year all over the Nation: the lesson that flood disasters are largely preventable. Much of the loss of human life, the billions of treasure, and the wholesale destruction of ecological values in Pennsylvania and adjacent regions in 1972 need not have happened.

It would have cost money to provide flood protection in the stricken areas. It would also have cost some land and other resources. But these costs would have been miniscule in comparison with this one year's cost of the failure to provide the protection. And there will be more floods in future years.

The damage in the flooded area is estimated at more than $3 billion. Federal relief costs alone are estimated to reach over $2 billion. State, local and private aid have not been estimated, but will also be huge. The $5-billion-plus cost of the flooding in this one relatively small area of the country in this one flood almost equals the total cumulative Federal cost of all the flood control projects in the entire Nation.

The 118 lives lost in the East, and the 236 more at Rapid City, S. Dak., cannot be evaluated in dollar terms. Neither can the wholesale obliteration of wildlife, scenic, and other natural values extending far beyond

The author, formerly an information specialist in the Department of the Interior and Office of the Chief of Engineers, has made a career of writing on water resource development programs.

The Big Sioux River, in the foreground, takes its toll of lives and property and leaves immeasurable environmental damage. Above, the Missouri stays well within its banks because flood structures in its upper basin are holding back the heavy runoff. This was a 1969 message, harshly repeated in other places in 1972.

the inundated area. Chesapeake Bay, for example, suffered damage extending scores of miles out to sea and may not recover for years.

Not included in most estimates, either, are the enormous losses — perhaps greater than any others — of the benefits the flood waters might have provided had they been controlled and saved. For example, the metropolitan area around Washington, D.C., faces a water-supply crisis of near disaster proportions within the next decade. A flood storage system, had one existed, could today be relieving that problem. The freshets of each normal spring, and the torrents of abnormal years, could be retained in reservoirs, as in so many savings banks, for wise future beneficial use. By placing turbines at the discharge outlets, critically scarce electric energy could be generated with no consumption of fuel, no smoke nor air pollution. Fish and wildlife resources would be preserved and enhanced, the estuarial environment better managed, and outdoor recreational opportunities multiplied many times.

What Happened — An Overview

During the last week of June 1972, 12 to 16 inches of rain fell on the Northeastern States. The amount of water has been estimated at 28 trillion gallons — far more than the existing 13,500 miles of stream channel could carry off as it fell. Though only some 5,000 square miles were inundated, 118 people died, 118,000 homes and buildings were ruined, and an estimated 114,000 people were thrown out of work temporarily or permanently. In all, about a half-million people suffered loss. The private cost has been estimated by George A. Lincoln, director of the President's Office of Emergency Preparedness, at $2.5 billion, the damage to public facilities such as roads and communities at $700 million and the Federal relief effort at $2.2 billion. Never before has any catastrophe approached such dimensions in dollar terms.

One of the worst hurt places was Wilkes-Barre, Pa., center of an industrialized valley that may never recover. Several large firms have already announced that they will not re-open. In Corning, N.Y., Corning Glass, Ingersoll-Rand, and 96 other business firms were wrecked; an estimated 7,000 people lost their jobs; railways, highways, and bridges were swept away. Lockport, Pa., a city of 28,000, suffered damage that threw well over 2,000 people out of work. Lewistown, Pa., suffered similar loss. Point of Rocks in Maryland, was virtually wiped off the map; historic Ellicott City, Md., with its textile mills, was smashed; and many other communities suffered similar fates.

Farther south, along the unprotected Dan River in North Carolina, the storm left cornstalks hanging from the electric power lines; small animal life, plant life, fields, and landforms were devastated. But in the adjacent Catawba and Yadkin Valleys, each protected by a dam, flood flows were cut in half, and the valleys with all their towns were saved.

Off to the west, a huge flash storm centered freakishly over a relatively small unprotected area just upstream from Rapid City, S. Dak., a town of about 50,000 people. On June 8 and 9, 236 people died in this one community — the worst death toll from flooding in the United States in the past 40 years. Almost 3,000 homes were devastated and almost a thousand totally destroyed, 284 businesses were damaged, vehicles and highways and bridges were washed away. The total damage has been estimated at $82.5 million.

Along with such tangible damage came incalculable damage to non-material values. The 200-mile-long scenic Chesapeake and Ohio Canal in Maryland, a national historical park, suffered 15 major breaches and additional minor ones in virtually every mile of its length. It has had to be closed to public access and use for about 130 miles. All bridges and 95 percent of the picnic sites were lost, thousands of trees uprooted, and an immeasurable amount of wildlife habitat destroyed in the nesting and young-rearing season. At Great Falls State Park, one bridge leading to the Great Falls of the Potomac was washed away and that central scenic attraction is closed off indefinitely. At Ft. Frederick State Park, 125 miles up the canal, a bronze and concrete memorial marker noting the 1936 flood — high water mark of 43.65 feet above normal level — stands amid the washed-out ruins left by this year's flood as mute testimony to a lesson that was not heeded.

At Seneca State Park in Maryland, three months after the flood the winding wooded riverbank was still slimy with muck and heaped with the litter of great smashed trees, floodborne debris, and wiped-out trails. It will be more than one season before the area recovers. Parts of Maryland's Patapsco State Park also may have to be closed for years. Throughout the devastated areas, rustic streams that normally meander through woods and pastures briefly ran amuck, tore away the soil, killed animals, ruined fish life, silted up pools, felled trees, and gashed hillsides on an indescribable scale.

A third of the shellfish in Chesapeake Bay were lost, according to Maryland's Department of Natural Resources. Many clam and oyster beds were buried under tons of floodborne silt; other shellfish were killed by the inrush of fresh water. Clams and oysters need a minimum salinity of 5 parts per thousand, but three weeks after the storm salinity was still only 3.5 parts per thousand along the western shore of the bay. The Potomac and Patuxent estuaries suffered unmeasured damage that may be even worse. Meanwhile, uncounted tons of debris made boating unsafe and pollutants washed from the bay fouled the water 80 to 100 miles out to sea. It may be years before the bay recovers.

Three months after the storm, a good fall oyster crop led some to believe that the damage might not be as bad as anticipated. But the Maryland Department of Natural Resources pointed out that the oyster set, from which seed oysters for future years are drawn, was virtually wiped out, along with almost all the clams in the bay area. Moreover, it appeared by September that 50 percent of the year's newly spawned herring, shad, white

perch, and striped bass had been killed. Most of these fish would not have been ready for harvest for five or more years; it is then that their loss will be felt. A main sheltering and breeding area for the surviving fish is the Corps of Engineers' Chesapeake and Delaware Canal, a 35-foot-deep, 450-foot-wide, 14-mile-long waterway connecting the Chesapeake Bay near Baltimore with the Delaware River below Philadelphia.

Flood control dams are sometimes opposed on the ground that they will inundate environmental values. But *nature's* 1972 impact statement shows that, in environmental terms as well as in dollar terms, the cost of providing protection may prove insignificant when compared with the cost of failing to build. As the *Enterprise* at High Point, N.C., aptly pointed out: "To those who did not have the benefit of well designed flood control, Miss Agnes was a polluter of mammoth proportions."

Need It Have Happened?

In contrast to this tale of stupefying loss and destruction is the story of the areas that *had* provided themselves with adequate flood-control projects.

At Pittsburgh, with its Golden Triangle, 10 flood control dams cut down the crest of the flood by 12 feet and saved three times their combined cost in a few days. The grateful *Pittsburgh Press,* in an article headlined "Engineers Were Right," said:

"It is impossible to tell how many lives were saved and how much damage was prevented by the building of the flood projects. But we can be grateful that the dam opponents didn't succeed." Later, Fred Jones, the *Press'* conservation editor, declared: "Pittsburgh's ring of 10 flood control dams saved the city from utter catastrophe . . . Instead of the $45 million in damage chalked up . . . damage would have soared over the $1 billion mark . . . All you have to do is look at the devastation that occurred in the unprotected Susquehanna River watershed to see what could have happened here if our dams had not been built."

Above York, Pa., the Army Engineers in 1938 built Indian Rock Dam. Some people have claimed it was a wasteful boondoggle, good only for sport and recreation. But this year in three days the dam repaid its cost three times over by holding 36 inches of water out of York. Major Harold L. Matthias of the Engineers reported: "I told the Mayor of York, the only difference between York and Wilkes-Barre is Indian Rock Dam."

Johnstown, Pa., is famous as the site of two historic floods. The legendary Johnstown flood of 1889 killed 2,200 people, that of 1936 killed 12 and put the city 18 feet under water. After the latter flood, the Army Engineers designed and built a channelization project at Johnstown; and in 1972, despite a record runoff, the city and its people were safe.

The West Branch in Pennsylvania crested six feet lower because of 12 dams that together held 22 billion gallons out of the swollen channels. Without those dams, the levees protecting at least two towns — Williamsport and Sunbury — would have been topped. Another dam, proposed but still unbuilt, would have cut the crest down still another six feet and saved much of the damage that did occur in this area.

The savings were felt all down the 1,000-mile-long Ohio River. At Memphis, Tenn., on the Mississippi just below the Ohio's mouth, the *Press-Scimitar* credited Army Engineer dams for the fact that the 1972 flood was "just another crest" which passed the city safely, 32 feet or more lower than in 1937 when the rain and runoff were less. Dams that cost $225 million, and had already saved $550 million in damage, in 1972 saved an estimated billion dollars more. Two more dams, blocked by lawsuits on environmental grounds, would have cut the crest another four to five feet and saved an additional $50 million to $60 million.

In New York State, a single $23 million dam that had already prevented $63 million in damage, saved $140 million more in 1972 while four small Army local protection projects saved another $5.5 million. On the Susquehanna, eight reservoirs and four local projects saved $370 million.

The spring floods of 1972 in the Missouri Basin provided an equally striking demonstration of the value of protection. Flood flows half again as large as those of the disaster year 1943 were retained safely by the Corps of Engineers' six dams on the main stream of the Missouri. As a result, Omaha, among other cities, instead of suffering a disaster of historic proportions, had no loss at all.

And in the Columbia Basin, where the 1,010,000 cubic-feet-per-second (cfs) flood of 1948 killed 30 people and left 60,000 homeless, this year the runoff was even greater, but damage was held to little or nothing. Flood control dams throughout the basin held the actual volume of water in the river to a safe 620,000 cfs. At Portland, Ore., and Vancouver, Wash., the river stages were stabilized at 21.5 feet; without the dams, they would have reached 31.5 feet. Damage in that area of the country begins when the stages reach 26 feet.

Elsewhere in the Columbia Basin, unfinished Libby Dam held the Kootenai River, a major tributary, to 25 feet. Without the dam the levels would have been 37 feet, and water would have topped all levees downriver and inundated the valley. Similarly, Boise, the Tri Cities of Washington State, the Flathead Valley and many other areas were saved. The estimate of $150 million in damage prevented by flood control projects in this basin seems very conservative. And of course the ecological and environmental damage that would have occurred in the wild mountain region is all but inconceivable.

Some Contrasts

Thus, flood losses are largely preventable. But they cannot be prevented by half-measures, shortcuts, simplistic approaches, or panaceas. For example:

Both Sunbury and Wilkes-Barre, Pa., had levees or dikes designed as parts of systems that were also to include upstream reservoirs; but the dikes were expected to hold only such flows as would be released from the

dams. Above Sunbury, 12 dams were built. When the flood came they did their job, the levees held, and the city was saved. But at Wilkes-Barre, once the levees were in place, there was little interest in adding the dams; only four of the planned 14 were built. In consequence, the levees were overtopped and gave way, and the city suffered catastrophic losses. The Army's Chief of Engineers, Lt. Gen. Frederick J. Clarke, has commented: "It could well have been a different story at Wilkes-Barre had the other projects been in."

One stream near Pittsburgh remained unprotected — the Clarion River. Down that one stream descended a sixth of all the floodwater that hit the Ohio Valley in the Pittsburgh region. If the proposed dam there had been built, it would have cut the flow from 68,000 to 2,000 cfs, knocked three feet off the crest of the Ohio, and eliminated most (if not all) of the $45 million damage that did occur at Pittsburgh.

One of the worst-hit towns in New York State was Elmira. In 1946, that town had been stricken by a flood flow that crested at 20.5 feet. When the flood was over, the community put up dikes adequate to keep out flows up to 22 feet, but two recommended supplemental storage reservoirs were never built. This year, flood flows crested at about 34 feet. The two dams would have lowered the crest to a safe 14 feet and prevented most, if not all, of the damage at both Elmira and Corning. The dams together would have cost an estimated $85 million when authorized. Today their cost estimate is $148 million. Even this figure seems modest when compared with the $100-million-plus damage suffered at Corning alone in just one week.

Three Lessons In Ten Years

The 1972 lesson is not novel. Year by year it has been repeated, as far back as history reaches. Here are highlights from the experience of just the past decade:

1969

In 1969, in California, projects that had cost the Federal Government some $340 million and local interests an additional $750 million paid for themselves in nine days by preventing $1.25 billion damage at Los Angeles alone. The appreciative Los Angeles County Board of Supervisors observed: "It is obvious that the vast amounts of money and engineering planning that went into developing the overall flood control system prevented one of the worst catastrophes in our history."

Farther north, at Oakland, the *Tribune* pointed out: "Lake Merritt did not spill over its banks into the downtown area, a raging Temescali Creek did not threaten Emeryville, mud slides did not destroy Oakland area homes, runoff from flooded ravines did not overflow into scores of Castro Valley homes, a rain-swollen Arroyo Mocho in Pleasanton did not inundate thousands of acres of farms and residential land, and Alameda Creek this year did not turn the Union City-Fremont-Newark flood plain into a vast lake . . . most of the credit for what didn't happen must go to the achievements of the Alameda County Flood Control District and the U.S. Army Corps of Engineers during the past two decades."

Not only was damage prevented, but the cost of disaster relief and rehabilitation was also saved — an often-overlooked benefit of flood protection projects.

While flood control projects were saving billions in California, another great 1969 flood was slowly moving down the Upper Mississippi Valley. Unlike California, this valley was largely unprotected. In consequence, in the St. Paul Engineer District alone, 15 people died, 4,400 homes were damaged, 40,000 families had to be sheltered, three million acres of farmland were damaged, and roads and highways were washed out. Total damage in that largely rural district was estimated at $108 million.

1964-1965

In the winter of 1964-65, all along the Pacific Coast from Canada to California, 20 or more inches of rain deluged ground that had previously been first saturated and then frozen. Forty or more lives were lost, 1,600 people were injured, nine towns completely wiped out and many others damaged. The Willamette River crested 1-1/2 feet higher than ever before in the 90 years of record. The Payette broke all records and flooded every square mile of its valley. In California, too, flows exceeded previous records by as much as 50 percent. Damage totaled an estimated $500 million.

But in areas that had flood control projects, $750 million to a billion in damage was prevented — to say nothing of a colossal relief effort. In the Sacramento Valley a levee and bypass system saved more than $150 million for the fourth time within a single decade, and Shasta and Folsom Dams $100 million more. Flood control works knocked 15 feet off the flood crest at Eugene (seat of the University of Oregon), seven feet at Salem, 10.5 feet at Oregon City. In the Willamette Basin, only nine dams of a planned 14 had been completed, but they saved a half-billion dollars — twice their combined cost — in this one flood by taking 14 feet off its crest. Boca and Prosser Creek Dams on the Truckee River saved Reno, Nev. Though runoff was the greatest ever recorded, the dams reduced the river crest by half. Anderson Ranch, Arrowrock, and Lucky Peak Dams in Idaho held in flows of 34,000 cfs while releasing only 150. This preserved not only the city of Boise, but wildlife resources of the basin below the dams.

In 1964-65, as in 1969, a few weeks after the Pacific Coast was stricken, floods also swept the Missouri and Upper Mississippi Valleys. In the latter valley, a month-long flood washed out most of the bridges across the main stream, destructively soaked whole towns, drove 40,000 people from their homes, and covered thousands upon thousands of acres of farmland with sterile, polluting muck. Total damage was estimated at $200 million.

The contrasting experiences of two Minnesota communities are instructive. Among the local protection projects authorized by Congress in 1958 were ones to protect an industrialized area at St. Paul, and another to protect the City of Mankato at the junction of the Minnesota and Blue Earth Rivers. The St. Paul project was

estimated to cost $6,750,000, of which local interests would pay $896,000; the Mankato project would cost $3,594,000, of which $404,000 would be borne locally. St Paul interests vigorously pushed their project, and it was completed in 1963. Mankato, however, decided that $404,000 was more than it wanted to pay. And in the spring of 1965 the St. Paul project prevented some $10 million worth of damage, while the unprotected city of Mankato suffered losses estimated at $5.5 million.

The semi-arid Missouri Basin, generally more receptive to water-resource development, in 1965 was largely spared heavy flood damage, thanks to completed projects which saved an estimated $64 million. As the *Kansas City Star* commented, in this valley "the big news may have been the floods that did not happen." The Manhattan, Kans., *Mercury* added: "The 'blessing' of these recent floods, if one dares call it that, is the spurring of the kind of action that will lead to more of these structures." And the Topeka, Kans., *Daily Capital,* under the headline "The Dams Go To Work," pointed out that although Kansas had suffered an estimated $6.5 million in damage, this was "a fraction of the damage that would have occurred had Kansas been without its system of dams."

AND EARLIER

The greatest of all American valleys, the Lower Mississippi, with the greatest of all flood potential, has furnished no such examples in recent years. After two centuries of recurrent colossal disasters, in 1927 that valley turned to the Army Engineers for a flood protection system, and it has not had a major flood disaster since. On the Missouri, after two successive "100-year" floods in two succeeding years, 1951 and 1952, the Army Engineers completed six big dams on the main stream, and there has not been a major disaster below those dams since they were built.

In New England alone, according to the U.S. Geological Survey, 605 floods have been recorded through the years on 127 streams. Of these, 416 occurred before 1900 — that is, before the auto, concrete pavements, and modern urbanization were known. Even in the 1600's and 1700's, though no records were kept, there were some 20 floods severe enough to be commemorated in records. The great flood of 1955, which took 93 lives and caused almost a billion dollars worth of damage, thus was only the latest in a continuous series. Yet today authorized dams are bitterly opposed by environmental interests in the region, and much of New England remains unprotected, awaiting the next disaster, which inexorably will come.

The Lessons

Thus history keeps repeating itself; it is up to men to learn. In the most violently emphatic way, *nature* has taught us again and again that:

1. Floods will always continue to occur.
2. Flood damage and loss are largely, though never entirely, preventable.
3. Flood waters can be converted from scourges into beneficial assets.

Yet many valleys remain unprotected, and many people still bitterly oppose projection and water-management projects. Here are some of the reasons why:

Some people are complacent. They believe floods cannot happen to them. Or if a flood has happened, they may say: "We've had our 100-year flood, so we don't have to worry any more."

Some people seek easier, cheaper, simplistic solutions to their flood problems. With floods, as with human illnesses, the purveyors of panaceas and quack medicines are always at hand and always find credulous listeners.

Some people take doctrinaire stands for or against given courses of action, then allow their attitudes to harden in the face of counter argument or demonstration.

Some people are not much interested in what happens to neighboring areas, and see no reason to support basin-wide community efforts.

Some people cling to certain favorite devices as cure-alls for flood problems, and oppose all solutions but their own favorites. A few years ago, vegetation cover was seen as the universal answer to flooding. Today, restricting the occupancy of flood plains is a popular cause.

But experience has shown that all means must be considered and used as appropriate, and new ones must continually be sought, in order to cope with natural forces as mighty as those that engender floods. No proven tool or technique should be either barred or demanded for doctrinaire reasons; instead, each situation and each valley must be studied on its individual merits. Flood plain regulation, floodproofing of structures, local protection, protective cover, channelization, bypass systems, levees, floodwalls, dams and reservoirs, emergency planning — all are equally legitimate devices in the flood fighter's repertoire, to be used and combined as needed.

Moreover, flood control is but one aspect of water management planning. Properly planned, one structure or system may serve not just one function, but several at once, thus saving the investment of money and resources required to cope with each separately. Hence to look at flood problems in isolation, while ignoring water supply or water quality or many other water-related functions, will not help, and may complicate, the problems of meeting those other water-related needs.

Today man applies the full range of his skill and technology to most of his conservation problems. Game is stocked, protected, and harvested through manmade programs and regulations. Fish are hatched and put into the waters artificially. Forests are planted, protected from fire and disease, cultivated, and cropped by human technology. Similarly, the soil, the wetlands, estuaries, migratory fowl, all are conserved and managed by man. Only with regard to water, the most basic resource of all, is there widespread opposition to sound conservation, management, and regulated use. *Nature's* impact statement of 1972, like the experience of earlier years, shows this to be a tragic conservational and human error. ■

for resource management

Evolving public demand, the grip on the tiller –

Man's compelling interest in the habitats of fish preceded this program of checking aquatic life and a related program of game fish production.

by O.M. Derryberry

Many of the difficult environmental problems facing the world today are really understandable only in the historical context in which they arose. Most arose out of some urgent need or desire and set mankind on a course which he could neither halt nor retrace.

Ancient man felt the need to communicate and to record. He devised written languages and means of counting objects. To record and preserve his thoughts, he needed something to write on. The Egyptians invented papyrus, the first primitive paper pounded flat from the reeds of the Nile. The invention of the printing press vastly increased man's ability to spread knowledge and information and the resulting requirements for paper have presented difficult environmental problems in our day.

Ancient man knew the need to move about, often carrying heavy burdens. He learned to use the rivers. He domesticated animals. The wheel gave draft animals greater capability. Steam made possible the railroad and the gasoline engine the automobile. We are struggling today with the deep environmental impact of auto transportation.

Man needed to light the darkness and devised the torch. Olive oil and whale oil used in lamps took its place. Then the discovery of petroleum made possible the kerosene and gasoline lamp. Electricity was the ultimate answer.

Man's urge to communicate, to ease his heavy physical burdens, and to dispel the darkness have been the driving force behind these developments and in none of these cases is it likely to diminish. Each represents the action, not of a single person or a group or a country, but the collective action of a total society. They are "social decisions." It is within the context of these social decisions that man today must solve his environmental dilemmas.

To produce the vast quantities of paper needed in today's society, forests must be cut to provide the wood and strong chemicals must be manufactured to convert this wood into paper. This process, if not properly managed by man, can set up a devastating chain reaction. Imprudent cutting of the forests can destroy wildlife habitats and adversely affect rainfall runoff patterns. Manufacture of the chemicals can release mercury into the streams to be concentrated in the flesh of fish. Other paper mill wastes can blacken a stream or produce an oxygen deficit, thus making the stream unfit for other desirable uses. And finally, the disposal of the discarded paper itself can create widespread litter and huge mounds of solid waste.

This example helps illustrate the major ingredients of today's environmental drama. On the one hand is an ever-rising standard of living on which man has come to depend. On the other is man's often undisciplined conquest of nature in satisfying these activities.

In order to maintain his present life style, man must rapidly acquire a basic understanding of nature, her resources, their ecological interrelationships, and his own role in this total picture. And from this understanding, he must fashion a second "social decision," a decision which gives equal priority to the consequences as well as to the desires of man.

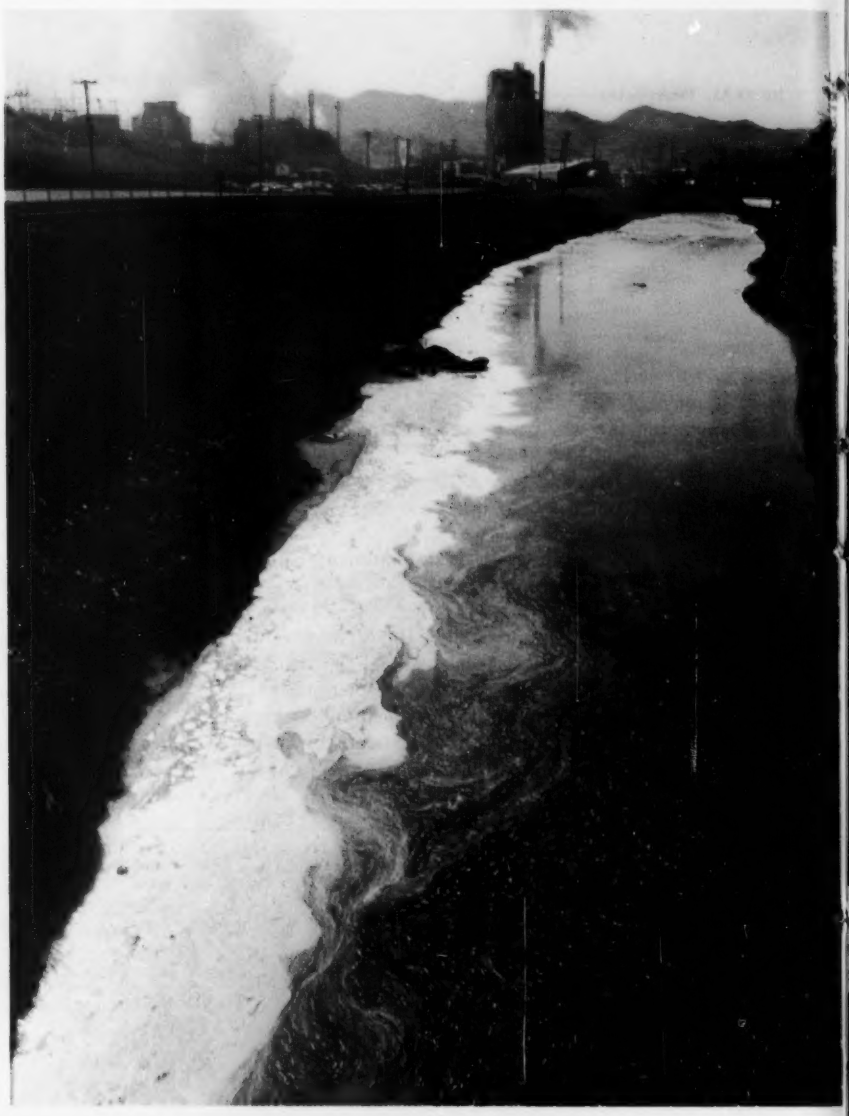
Change, imbalance, and upheaval are the unending realities in nature. Violent natural eruptions — volcano, earthquake, flood, and fire — these were the phenomena which helped produce the coal and oil deposits, molded the mountains and plains, and influenced the succession of one species of life after another, leaving only that which could adapt to survive.

By these changes and by others less violent — by a lively stream cascading over rocks and by great stands of conifers absorbing some of the waste gases of man and giving off life-producing oxygen — nature continually renews herself. She replenishes the forests, heals erosion, and makes harmless the poisons of man.

Man has always been an active participant in the earth's ecology. He has fought — successfully in some instances and unsuccessfully in others — to control many of the damaging imbalances in nature. His dams have tamed floods and his pesticides have checked the advance of the boll weevil. His technology also has unlocked the secrets of the atom and of outer space and has transformed many of nature's raw ingredients into tools to serve man's needs and desires.

An environmental policy which pretends that man isn't anywhere around is not valid. Since man multiplies, consumes, and invents, he inevitably produces environmental change. The problem is to manage this change so that it contributes to life rather than destroys it.

Dr. Derryberry, retiring this winter after 36 years with the Tennessee Valley Authority, has been serving as manager of Office of Health and Environmental Science, directing and coordinating a major part of TVA's environmental quality activities.



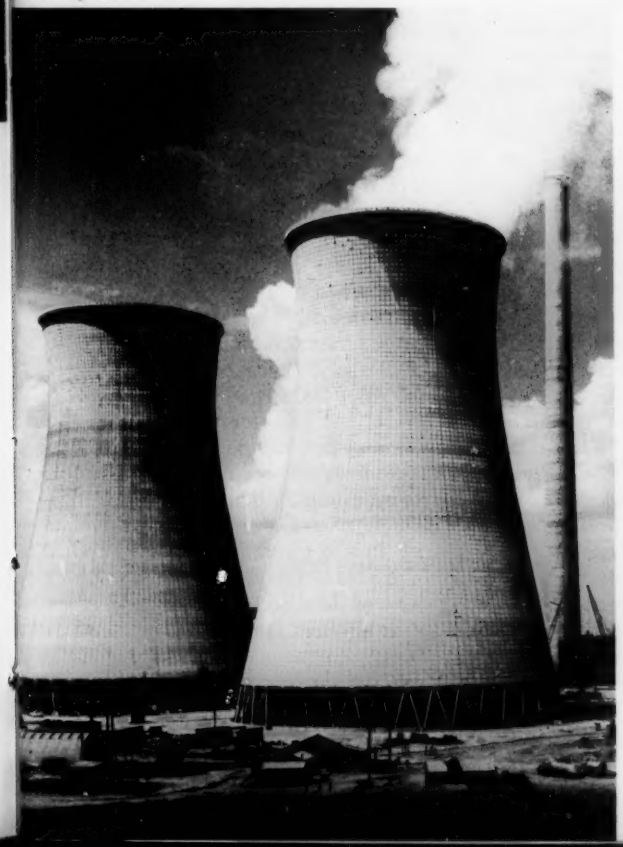
Industries are joining the public in its basic decision to clean up the Nation's waterways. This mill has started a $6 million expansion of its waste treatment facilities.

Visible pollution, such as this below, has stimulated a public consensus that resource abuses must be corrected.

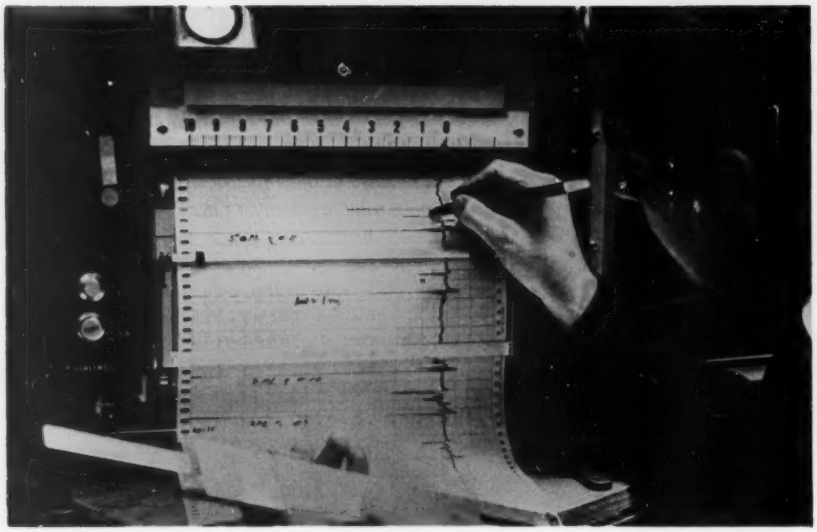
Watershed reforestation and conservation are, in addition to meeting economic needs, responses to man's desire to protect and replenish resources he uses.

Various forms of recreation, such as this, command a place of priority when environmental consequences from undisciplined uses of resources are balanced against desired life styles.

More than economic considerations led to the construction of these giant cooling towers to minimize the effects of heated water on an adjacent river.



The monitoring of radiation levels in the environment surrounding new nuclear plants will establish baseline measurements. Applying new knowledge to solve any detectable environmental problems, however, will depend on the social value assigned.



Technology tends to produce what society demands, and in this instance the scientific data being gathered is being used in a continuing program for improving water quality.

The man who, according to the story, unloaded a fishbowl of Eurasian watermilfoil into a TVA lake to improve fishing habitat, unaware of the consequences, managed badly. He created a problem which threatens water recreation in many lakes. Millions of dollars have been spent seeking a control for this noxious weed. The total solution has not yet been found.

The paper manufacturer or electric power generator who produces his product and allows his untreated wastes to pollute the surrounding air and water also manages badly.

The eutrophication of the Nation's lakes and rivers concerns many. Man can mismanage by overloading the receiving body of water, but he also can plan his own waste management to help prevent undue eutrophication.

This points up the major environmental need of our time: A creative partnership between man and nature, a partnership which demands that man look ahead and consider the total impact of his technology before applying it. This is an essential part of the management which man must inject into the process of inevitable change in his relationships with the earth.

The Tennessee Valley Authority, unique among public agencies, is able to bring interdisciplinary action to bear in this fashion on the economic and environmental problems of the Tennessee Valley region. The fish and wildlife biologist can advise on the aquatic effects of a new dam or steam plant. The hydraulic engineer and soil scientist can determine the nutrient runoff from forest or field. The water quality expert and recreation specialist can work out in advance measures to maintain clean scenic streams.

The Tennessee Valley is, in fact, a large environmental laboratory where many potential environmental problems can be recognized in advance and solutions worked out on the spot by interdisciplinary teams.

When it began building its chain of lakes to harness the power of the Tennessee River system for the good of man, TVA health experts knew that the creation of the lakes could aggravate the malaria problem in many areas by creating long, new reaches of marshy shore where the malaria mosquito breeds best. So the river managers, working with the biologists and health experts, devised a system under which the lakes during the mosquito breeding season are alternately lowered and raised about a foot in a cycle taking about a week. This successfully strands the mosquito larvae to die or exposes them to become food for fish. The forecast was right and the remedy worked. Malaria of local origin disappeared from the region.

Some aquatic biologists forecast that the reservoirs would become "biological deserts" unable to support a fish population. In an abundance of caution lest this prediction prove accurate, TVA built fish rearing ponds near Norris Dam so the lakes could be restocked. But the forecast was wrong and the unneeded rearing ponds were abandoned many years ago.

This same interdisciplinary approach which helped solve some of the fundamental environmental problems of four decades ago is being applied to the more complex problems of today.

On the new Normandy Dam, which TVA is currently building on the Duck River in middle Tennessee, fisheries experts, water quality specialists and design engineers have worked together to devise a system of water releases aimed at guaranteeing a year-round supply of cold, oxygen-rich waters just below the dam. The problem of high temperatures and low dissolved oxygen content in waters released during the late summer and early fall has long hindered the creation of trout fisheries below many dams. Hopefully, the experience on the Normandy project will point the way toward a solution of this problem in future dam and reservoir projects.

As it enters the period of nuclear power generation, TVA is taking precautions to protect the environment which are probably more extensive than at any time in the past. Calling upon its 25 years of experience with coal-fired steam plants, TVA is installing equipment and setting its operating schedules to assure that heated water produced by the plants will have no marked adverse effect upon aquatic life in adjacent streams. At the same time, scientifically designed experiments will be conducted to learn more about the responses of plant and

fish life to slight rises in temperature in the Nation's streams and rivers.

These examples help illustrate that technology offers an important weapon for curing the ills which it helped create. Technology, which unraveled the mysteries of electricity and the atom and of chemistry and physics to produce the thousands of commodities which society today regards as indispensible, can even today control most pollutants considered harmful to life. Over time, it can control others, devise recycling systems to use many current waste products, and develop less destructive manufacturing methods in many industries.

But, in essence, technology tends to produce what society demands. Without the "social decisions" requiring the full application of the science of technology, the benefits which this knowledge can bring are lost.

Sanitary engineers, aquatic biologists and others knew for years, for example, that Lake Erie was deteriorating from the municipal and industrial waste dumped into it. The basic technology of treatment of sewage and many other wastes had been known for many years and its application would have greatly reduced the pollution problem. But action had to await a popular demand, an aroused citizenry, a "social decision" that not only Lake Erie, but all lakes and streams must be cleaned up.

In the Tennessee River Valley, TVA put its interdisciplinary team to work on the problems of water pollution in the region in the mid-1930s. Waste treatment, as a science, was generally known at that time, but this knowledge was not being applied. Raw wastes from cities and industries were pouring into the streams, making long stretches of them little more than open sewers and preventing their use for more economically rewarding purposes.

Although it lacked enforcement powers, TVA accumulated vast quantities of data, worked over the years to strengthen state pollution control programs, to convince local governments of the need for improvements, and to regulate the discharge of wastes over its own properties. The result is a cleaner Tennessee River today than it was then, even though more than 200 major industries have been added along its shores and waterfront cities have experienced unparalleled population growth.

Today we know more about the quality of water throughout the length of the Tennessee drainage basin than is known for any comparable area in the world. TVA's experts have pinpointed virtually every major source of harmful pollution remaining and continue to work toward the day when these too can be controlled.

But the long and difficult struggle to clean the Nation's rivers and lakes — whether it be the Tennessee River in the South or Lake Erie in the North — is not an issue unto itself. The problem of water pollution is bound up in the complex web of the total environmental drama — a drama being played out not only in the laboratory, but also in the classroom, the factory, the legislative hall and executive chamber, and, most importantly, in the living room of every American home.

There the "social decisions" are made on the issue of paying the costs necessary to apply the tools of science and technology to solving not only water pollution, but the entire range of outstanding environmental problems. All agree that the costs will be heavy; no one is sure of the ultimate figure.

In the Tennessee Valley, TVA estimates that it will be spending more than a million dollars a week during the current fisal year on environmental protection programs. Next year, this figure is likely to almost double. Most of this cost is associated with the agency's electric power generating program and must be paid ultimately out of customers' electric bills. The impact on electric bills will be significant. The average per family cost for actions already planned is calculated at about $33 a year. This could increase to as much as $360 a year in the future if more extensive measures prove to be needed to meet a variety of new State and Federal regulations now being considered.

The costs of environmental protection, however, must go far beyond merely buying the hardware of pollution control — the electrostatic precipitators, sewage treatment equipment and garbage collection and disposal systems. They must involve the training of competent scientists and technicians to design, install, operate, and monitor the sophisticated equipment. They must involve the staffing of government agencies — local, State and Federal — with well trained and well paid scientists and the equipping of these agencies with the technical and legal tools necessary for establishing and enforcing uniform standards. They also must involve the training of administrators and social scientists who are attuned to esthetic values such as a tree-covered hillside, a clear stream, or a scenic overlook.

Environmental protection, then, must involve the entire fabric of society and the basic value systems of man.

Nature will continue to yield the raw materials necessary for most of the essential activities of man so long as man applies the same degree of ingenuity to replenishing and conserving nature's supply as he does in satisfying his own demands.

Yet, no one can deny the extravagancies of some of these demands. As society contemplates the costs and consequences of its past decisions, it almost certainly will ask searching questions concerning the goals and priorities which led to many of these demands. This could lead to a redefinition of progress, a definition tied less to the abundance of "things" and more toward a quality of life where goals such as better health, higher education, and enlightened culture will be given a higher priority. This "social decision" may be basic to all the others. ■

Events, Deeds & Deliberations

Parts of Water Quality Act Expand Corps Functions

The Federal Water Pollution Act of 1972, with the Environmental Protection Agency (EPA) having the primary responsibility, gives new thrust to a massive research and action program. The act discontinues the issuance of permits by the Corps of Engineers for discharges into navigable waters, under the Act of March 3, 1899, and transfers this work to EPA in a broader permit authority. Other new provisions call for expanded Corps participation in the effort for cleaner water, and following are examples.

Under Section 208(h), the Corps, in cooperation with EPA, is authorized to provide technical assistance requested by States or organizations, making knowledge and experience gained from the Corps wastewater management and comprehensive planning studies available to the States. To accomplish the Corps wastewater planning assistance program, an amount not to exceed $50 million for each of fiscal years 1973 and 1974 is authorized to be appropriated to the Secretary of the Army.

Under waste water management for Lake Erie, Section 108 (d), the act directs the Secretary of the Army, acting through the Chief of Engineers, to design and develop a demonstration waste water management program for the rehabilitation and environmental repair of Lake Erie. Prior to initiation of detailed engineering and design, the recommended program is to be submitted to Congress for approval. The program will be developed in cooperation with the Environmental Protection Agency and other interested Federal agencies and States. The section directs that the program set forth alternative systems for managing waste water on a regional basis and provide State and local governments with a range of choice. The alternative systems are to include both advanced waste treatment technology and land disposal systems. This authority is to be in addition to other waste water studies in the Lake Erie region.

Under comprehensive studies of estuaries and estuarine zones, Section 104(n) directs the EPA Administrator, in cooperation with the Secretary of the Army, the Secretary of Agriculture, the Water Resources Council, and other appropriate Federal, State, interstate, or local public bodies and private organizations, institutions, and individuals, to conduct and promote continuing comprehensive studies of the effects of pollution, including sedimentation, in the estuaries and estuarine zones of the United States on fish and wildlife, sport and commercial fishing, recreation, water supply, water power, and other beneficial purposes. The studies will also consider the effect of demographic trends, the exploitation of mineral resources and fossil fuels, land and industrial development, navigation, flood and erosion control, upon the pollution of estuarine zones. Reports to Congress at least every three years are required. (An article in the next issue will discuss the relation of this provision on the study of estuaries to the Coastal Zone Management Act.)

Surgery for Laguna Madre

Help is on the way for the finny victims of the Laguna Madre's infamous "fish graveyard" on the Texas Gulf Coast.

The Texas Parks and Wildlife Department, the U. S. Bureau of Sport Fisheries, the National Park Service and the U. S. Army Corps of Engineers are joining forces in planning an escape route for the fish.

The "graveyard" is a depression in the Laguna Madre south of Baffin Bay and partially in Padre Island National Seashore which traps fish during summer low tides. The fish have access to the area during high tides but are unable to escape once the tide goes out. They are left in a shallow pool which becomes more salty as the water evaporates. Tons of fish have died in this area for many years.

The rescue effort will be in conjunction with the Corps' maintenance dredging of that portion of Gulf Intracoastal Waterway that runs through the Laguna Madre. The Corps is performing the work, jointly recommended by all the cooperating agencies, by creating several major openings between spoil banks to improve water circulation and resultant fish movement. In addition, a channel approximately two miles long will be dug to the center of the danger area.

Texas Parks and Wildlife Department officials say that when the work is completed, the massive fish kills could be a thing of the past with properly maintained channels.

Harvest for Detroit

As when man washes one hand he feels compelled to wash the other, he tends to clean up his watersheds when he improves the quality of his streams. That interrelationship, as discussed in more academic terms elsewhere in this issue, may be one of the reasons the Tennessee Valley is taking part in a drive to rid its roadsides, streambanks and other places of abandoned automobiles.

In any event, 22 city and county governments in the area are conducting local and regional junk car collections as part of a TVA demonstration aimed at restoring scenic beauty and showing how junkers can be collected at economical cost even from out-of-the-way spots.

Under this program, TVA lends special collection vehicles on request to Tennessee Valley cities and counties for up to four months for use in local collection drives. These collection vehicles are less expensive to build and operate than conventional wreckers. The method appears to have a ready market across the country. More than 150 localities in 34 States have shown interest in setting up their own junk car recycling projects.

Holdup of Runoff

Methods of controlling the rate of rainfall runoff in urban areas are being studied at the Institute for Research on Land and Water Resources, Pennsylvania State University, under a Corps of Engineers grant.

Work supported by the study grant, made by the Corps' Hydrologic Engineering Center, is adding to the exploration of urban runoff problems such as those discussed in "Storm Water for Fun and Profit" appearing in the Fall 1970 *Water Spectrum.*

One method being studied involves placing a series of four-inch high barriers of quarter-inch gravel on flat roofs. In an experimental setup the barriers cut the peak of runoff by about 50 per cent, thus doubling the runoff time span.

Extensive installation of such barriers on flat roofs in an urban watershed could be expected to delay runoff in a similar manner, thereby giving storm sewers more time to carry off storm waters.

New Wave of Forecasting

Now that information about the state of the ocean, under a program of UNESCO's Intergovernmental Oceanographic Commission, is being exchanged for the first time among several nations in the same way they handle weather reports, fishermen will be able to obtain water forecast conditions within 23 hours. This data will also include conditions pertaining to wave heights for shipping, and on the likely effect of the sea on the atmosphere for meteorologists. Canada, West Germany, the United Kingdom and the United States are participating in the project.

Log Water Mains

Hollowed-out logs, which brought water to early settlers in Albany, N. Y., when it was a Dutch colony, have been discovered beneath a busy downtown street. The water system, built in the late 1670s, consisted of hollowed-out logs with planks nailed on their flattened tops.

The logs were tapered at one of the ends to allow for their joining into another conduit. The log mains brought water from near Fort Frederick, the second fort constructed by early Dutch settlers. An archeologist characterized the system as perhaps being the first hydraulic engineering project in the United States. ■

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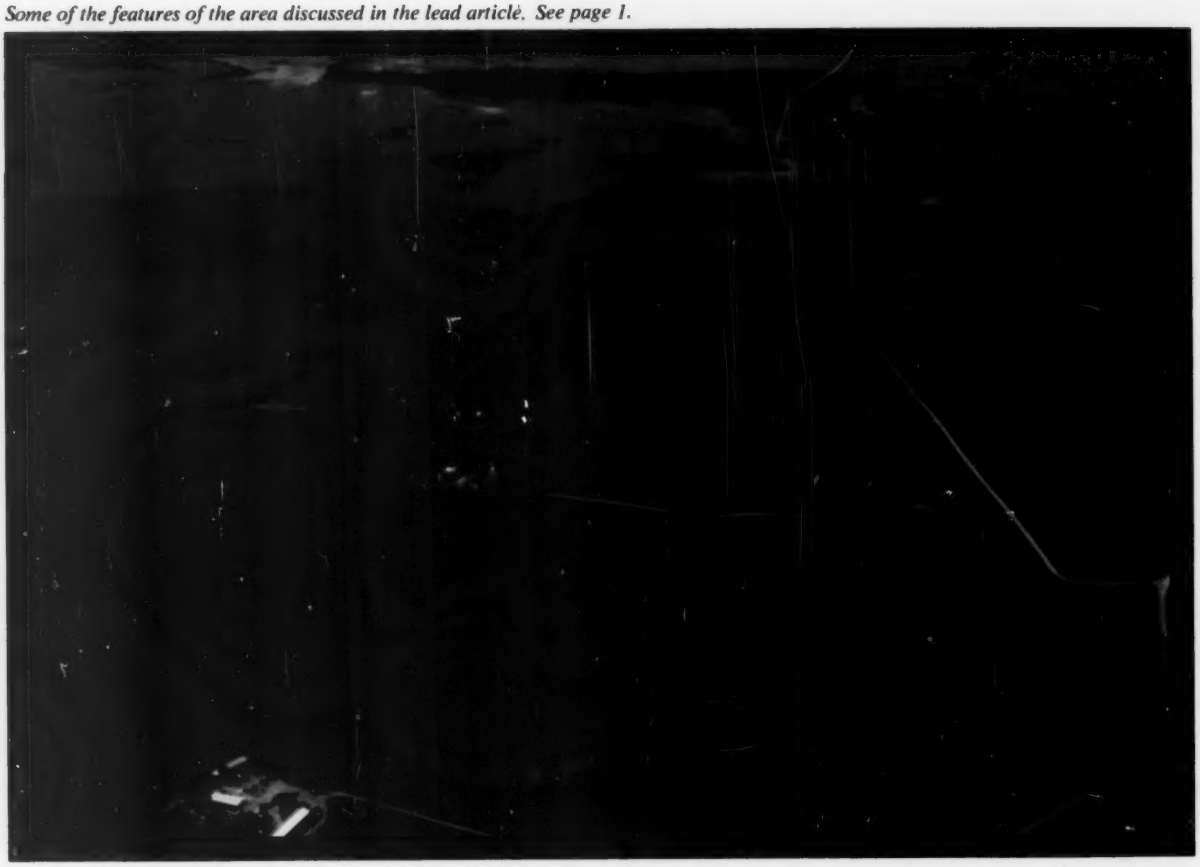
Some of the features of the area discussed in the lead article. See page 1.